SCIENTIFIC AMERICAN

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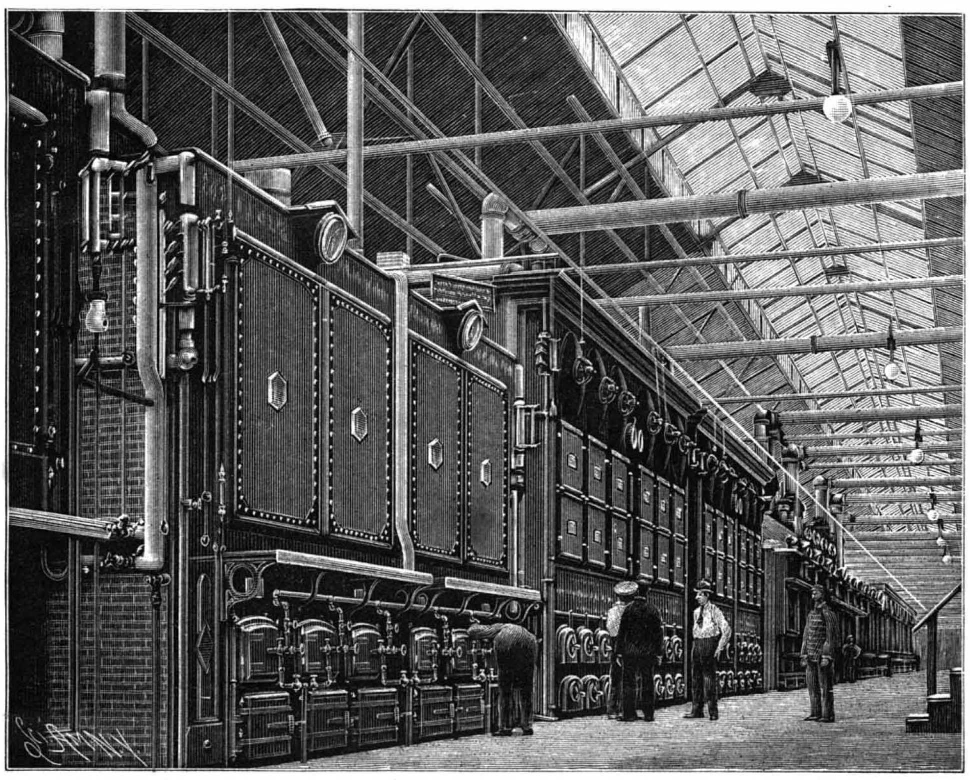
OIL FUEL AND BOILERS AT THE GREAT EXPOSITION.

The motive power for the great Exposition at Chicago is chiefly supplied by a great assemblage of water tube boilers—the greatest in number and operating power ever before collected in one locality. The fuel used is oil. We present beneath in our first engraving a view of a portion of the great boiler house, which in fact forms a part of the Palace of Machinery. Our second view shows the type of burner used for the combustion of the oil; the operation of which will be readily understood by a glance at the picture. The burner consists simply of a tube which enters through the front of the boiler into the combustion chamber. The oil, under a pressure of 6 pounds to the inch, rises through the pipe marked "oil" into the burner, and is atomized and blown into the combustion chamber in the form of a fine mist, by means of a steam pipe, which passes centrally through the burner, and delivers its steam jet at the extreme end of the burner tube as shown. A great flame of gas is thus produced, with intense heat. The handling of coal and ashes is thus avoided, while economical results of the most satisfactory nature are attained. These oil-burning boilers attract much attention from engineers.



OIL-FIRED BOILERS AT THE GREAT EXPOSITION.

Other interesting exhibits pertaining to the use of oil are the oil engines, in which vaporized oil takes the place of steam in driving the pistons of engines, thus doing away with the steam boiler. Some of these exhibits form the subjects of illustrations which we present on another page. Returning now to the great boiler room, or main power plant, there are fifty-two boilers, which generate steam for eighty-three engines. One of the best descriptions of this plant is that recently given in the Chicago *Tribune*, and from it we make the abstracts that follow :

The boilers have a rated horse power of 20,500, but they are capable of developing a horse power greatly in excess of the rating within the limits of economy. They evaporate about 750,000 pounds of water per hour and burn about 50,000 pounds of oil in the same length of time. One pound of oil will evaporate about fifteen pounds of water. Assuming the evaporation to be 750,000 pounds of water an hour, the horse power generated would be 25,000.

The permanent form which the water tube boiler has now assumed consists of a bank of tubes, usually 4 inches in diameter and from 12 to 18 feet in length, inclined upward at an angle from the rear, surmounted by a water and steam separating drum from 30 to 50 inches in diameter and about the same length as the tubes. The tubes are expanded into boxes or headers at each end, and these headers are connected with the drum above by circulating tubes or other connections. A clear idea of the details of construction and of the variations in different makes may be obtained by reference to the accompanying illustrations. When in use the tubes, headers, and connections are filled and the drum is half filled with water. The water level is carried about the middle of the drum, which, on account of its comparatively large diameter, offers an extensive disengaging surface. This is necessary for the production of dry steam. The furnace is placed under the bank of tubes. The flames circulate around the tubes, being guided up and down by suitable passages so as to cause them to give up as much heat as possible before escaping up the chimney. Connected with the rear end of the tubes and removed from the action of the flames is placed a mud drum for the collection of sediment. The sediment can be readily blown out at suitable intervals.

The boilers in the power house are furnished by eight exhibitors. Beginning at the east end of the boiler house the arrangement, number of boilers, and rated horse power are as follows: Abendroth & Root, four boilers, 1,500 horse power; Gill Water Tube Boiler Company, four boilers, 1,500 horse power; Heine company, eight boilers, 3,000 horse power; National, four boilers, 1,500 horse power; Campbell & Zell, nine boilers, 3,750 horse power; Babcock & Wilcox, ten boilers, 3,000 horse power; Stirling, four boilers, 1,800 horse power. In the annex are four Heine boilers of 1,500 horse power, three Climax of 3,000 horse power, and two Stirling of 900 horse power. These boilers, while separated from the main boiler room by the south entrance to Machinery Hall, are connected with the main system the same as any of the other batteries. They are not yet in use, however. All the boilers, as will be seen by the illustrations, are of much the same type, except the Climax, which is vertical, with U-shaped tubes opening into the central drum. The Jumbo of the boiler house is a Climax of 1,000 horse power.

The Abendroth & Root boilers have 126 tubes four inches in diameter by 18 feet in length, arranged in courses 14 wide by 9 high. They have 7 drums 14 inches in diameter by 20 feet in length, and one header 30 inches in diameter by 12 feet in length. The Gill boilers have 360 tubes 4 inches in diameter by 18 feet in length, 3 steam drums 42 inches in diameter by 21 feet long. The National boilers have 180 4-inch tubes 18 feet long and 3 steam drums 36 inches by 20 feet. The Campbell & Zell boilers have 236 4-inch tubes 18 feet in length, 3 30-inch water drums 19 feet in length, and one steam drum 52 inches in diameter by 12 feet in length. The Babcock & Wilcox boilers have 126 4-inch tubes 18 feet long, arranged in courses 14 wide and 9 high, a mud drum 12 inches in diameter and 8 feet 6 inches long, and 2 steam drums 36 inches by 18 feet. The Climax 500 horse power boilers have a main shell 42 inches in diameter by 29 feet high. The main shell is ¾ of an inch thick, with vertical seams welded. Each has 475 tubes 3 inches in diameter and 11 feet 6 inches long before bending.

The monster 1,000 horse power boiler Jumbo has a main shell seven-eighths of an inch thick. It is 56 inches in diameter and 35 feet 8 inches high. It has 864 3-inch tubes which were 12 feet 6 inches long before bending. It is capable, it is said, of developing 1,800 horse power.

(*Continued on page 22.*)

THE WORLD'S COLUMBIAN EXPOSITION—THE BOILER OIL BURNERS.

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Contents.

(Illustrated articles are marked with an asterisk.)

Boat, war, submarine.......... 22
Boilers, oil-fired, at Exposition*.. 17
Book. music, Ayres'.......... 20
Burners, oil*.......... 17
Campania, the.......... 22
Cement for rubber and leather... 21
Cleanliness, first law of health.... 21
Coal, waste of.......... 26
Contagion, do doctors spread?... 27
Dam, Austin, failure.......... 22
Dandruff, pomade for.......... 23
Engines, oil, at Exposition*....24, 25
Enterprises, enormous.......... 24
Excursions, scientific.......... 18
Exposition notes.......... 19, 26
Exposition, to see in a week...19, 26
Fuel, oil, at Exposition*........17, 22
Gin, cotton, Montgomery's*.......... 20
Gold, bright, in France.......... 22
Grubber, root, electric.......... 23
Hog, wart*.......... 27
Inventions, rule of contrariety in 24
Irrigation project, gigantic.......... 24
Items from *Science Gossip*.......... 23
Medal, Ericsson.......... 26
Metroscope, Baillie's*.......... 20
New York and Boston only five hours apart.......... 23
Paper to prevent forgery.......... 18
Paper, wall, curious.......... 27
Parson Horological Institute*.... 23
Physics, solar, discovery in 18
Poison, ivy, remedy.......... 22
Power, motive, centralization of. 18
Problems, unsolved, Edison studying.......... 25
Rattlesnakes, experiments with.. 18
Ships' bottoms, electroplating 22
Tension, surface*.......... 21
Ties, metal, in Mexico.......... 27
Tricycle, new use for.......... 18
Trunk, mysterious*.......... 20
Water, purification of.......... 27
Windmills, horse power.......... 21

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 914.

For the Week Ending July 8, 1893.

Price 10 cents. For sale by all newsdealers.

PAGE

I. ARCHÆOLOGY.—Prehistoric Pottery on Exhibition at the World's Columbian Exposition.—By HENRY HALES.—Pottery from New Mexico.—The story of its discovery and illustrations of the articles.—9 illustrations.......... 14602
The Tell el-Amarna Tablets.—By the Rev. THOMAS HARRISON.—The famous tablets and the r relation to biblical chronology.......... 14603

II. ASTRONOMY.—The Leonids or Meteors of November 13.—By DANIEL KIRKWOOD.—An interesting and popular account of the great meteoric shower of 1833, and the probability of its recurrence.—1 illustration.......... 14604
The Recent Eclipse of the Sun.—Photographs from West Africa of the total eclipse of April 16.—3 illustrations.......... 14605

III. CHEMISTRY.—Fixers of Nitrogen.—By M. BERTHELOT.—Fixation of nitrogen by soil organisms.......... 14613

IV. CIVIL ENGINEERING.—Our Pavements.—By JOHN DONNELLY.—An elaborate paper on the experiences of Kansas City with different paving materials.—Their cost, duration, and availability.......... 14609
The Construction of a Watertight Masonry Dam.—By WALTER MCCULLOH.—A full account of Sodom dam, and methods adopted to make it perfectly watertight.—5 illustrations.......... 14606

V. COLUMBIAN EXPOSITION.—The Columbian Exposition.—By JOHN MCGOVERN.—A comprehensive and brief review of the Exposition as a whole, and of the transportation problems involved in it.......... 14599
The International Exposition at Chicago—A Street in Cairo.—Notes of interesting features of the Exposition, from a German observer.—2 illustrations.......... 14599
The World's Fair at Chicago.—Spirited sketches by FREDERIC VILLIERS of scenes in the Exposition.—3 illustrations.......... 14601

VI. ELECTRICITY.—Electrical Power.—A popular explanation of the dynamo.......... 14610
Paper Insulation.—A lead-covered cable, with paper insulation.—1 illustration.......... 14611
The New Wimshurst Influence Machine.—A novel construction of the well known influence machine.—1 illustration.......... 14611

VII. MECHANICAL DRAWING.—A Compass for Drawing Sp rals.—A curious relic.—A compass for producing spirals.—1 illustration.......... 14612

VIII. MINING ENGINEERING.—The Utilization of Coal Mines.—A suggestion for establishing steam plants in coal mines to develop power at low cost.......... 14608

IX. NATURAL HISTORY.—A Gigantic Land Turtle.—A 352 pound turtle of the Mauritius Island.—1 illustration.......... 14603
The Beaver and His Ways.—By S. L. CLAYES.—A popular and accurate account of the life habits of the beaver and of his constructive ability.......... 14603

X. NAVAL ENGINEERING.—Marine Messenger Balls.—Simple method of securing communication between wrecked vessels and the shore.—3 illustrations.......... 14610
The Car Ferryboat Ste. Marie.—A powerful steamboat of 4,000 horse power for transferring cars.—1 illustration.......... 14610
The Cup Defender Pilgrim.—The great fin keel in dry dock ready to receive her fin.—1 illustration.......... 14610

XI. PHOTOGRAPHY.—The Daguerreotype Process.—Notes on the daguerreotype, and how to produce them.......... 14612

XII. PHYSICS.—An Inexpensive Micrometer.—A simple and accurate cathetometer.—2 illustrations.......... 14612
The Atmosphere.—The chemistry and physics of air.—*Resume* of most interesting series of lectures delivered by Professor Dewar at the Royal Institution.......... 14605

XIII. PHYSIOLOGY.—An experimental study of the Seat of Cutaneous Sensations.—By CHARLES L. DANA.—The sensor and motor faculties in man.—A curious research.—1 illustration.......... 14613

XIV. RAILROAD ENGINEERING.—The Twenty-Hour Trains Between New York and Chicago.—A review of the Exposition flyer trains run by the New York Central Railroad.......... 14601

XV. TECHNOLOGY.—Notes on C emical Manufacturing in Russia.—By R. BOWMAN.—The manufacture of sulphuric acid and soda and caustic alkali in Russia.......... 14613
The Cambray Sugar Process.—A process for recovering the sugar left in the bagasse.......... 14611

THE CENTRALIZATION OF MOTIVE POWER.

For a number of years the distribution of power over a large area from one or more producing centers or stations has been a problem of engrossing interest to engineers. Before the advent of modern electricity—for such a name may be considered the due of this greatly developed industry—all sorts of methods were proposed for the distribution of power. Many of such methods have been utilized. Thus in pipe conduit systems compressed air, rarefied air at a very slight excess over atmospheric pressure, and water under high pressure have all been utilized as the bases of more or less successful and extensive operations. As a purely mechanical method the transmission by wire cable has proved reasonably effective. A light cable running at high velocity has proved itself suited for transmitting very high horse power for great distances.

Electricity has now been found capable of doing this class of work with good efficiency. The alternating current, working under high pressure, needs but a small wire to carry a large horse power. The high speed cable transmission alluded to above is comparable to it in this respect.

The transmission of power over considerable distances is so far proved that a new movement in the engineering world in the direction of centralization of power is discernible. Doubtless this movement will, in the next few years, be fraught with most important results. In this country, especially, it has taken root. Thousands of horses are now employed drawing street cars through the streets of our cities. This means a division of power into very low units, without any centralization whatever. Within the last few years the great street railroads have felt the impulse, and in our large cities, by the use of the cable and slot or by the electric trolley line, have centralized their power and have substituted each a single unit of thousands of horse power magnitude for the many one or two horse power units formerly assigned to each car.

In the suburbs of the same cities the electric road has been greatly developed. The motor machinery for a car carrying thirty to fifty passengers is of inconsiderable weight, giving a high efficiency from the point of view of ratio of weight moved to load carried. The generation of power at a central station is far cheaper than where small generating plants—the boilers—are distributed in locomotives all along a railroad line. These advantages are such as to have made the electric road a serious rival to steam roads. It is easy to believe that the day will come when the locomotive engine will be relegated to an altogether secondary place in the economies of mankind

Electric power is now furnished by the city companies. This has made possible the installation of small factories, so that in the best buildings in our best streets workshops are established with machinery driven by electric motors. But most of the great factories still run in the old way. At Niagara Falls the project of providing power for factories of the largest size will soon be accomplished. An industrial city will be erected about the nucleus of the power works, electric railroads will be run from them, the lighting of neighboring cities will be provided for, and Buffalo will possibly be the recipient of many thousands of horse power from the same place.

Transmission of power by electricity is now an accomplished fact. The production of power economically in central stations is the problem to be solved. Such a locality as Niagara Falls contains in itself the solution. But Niagara is unique. Natural gas seems to be on the decline. The old time coal fire and steam boiler are still in the ascendency. In the SUPPLEMENT of the present week an interesting paper contains the suggestion of establishing steam plants in coal mines. Coal as such is of exceedingly slight value. When extracted from the veins and lying on the floor of the mine, it represents but little. But after coal has been hoisted or drawn out of the mine, has been screened and placed in cars, and after these cars have carried it perhaps two or three hundred miles to the seaboard ; after it has been transferred to vessels and has been towed hundreds of miles further to the wharves of some city, and has been hoisted out of the vessels' holds, then its value is enhanced.

By establishing an electric plant in the heart of a coal mine, the fuel account would be almost nothing, and a rival of Niagara Falls might be established. From some coal mine in the heart of Pennsylvania, power might be distributed over a great area, including cities and railroads on all sides. The culm heap would disappear, ashes would be stored in the empty chambers, and future geologists would have these ashes to deal with as examples of igneous changes, while fossil men and boilers would interest the archæologist of the fuelless days yet to come.

A CONCRETE BRIDGE.—A bridge of concrete is being constructed over the Pennypack Creek at Pine Road, Fox Chase, Pa. The outside surfaces will be pebble dashed and outlined in imitation of pointed stone work, so that when completed it will present the appearance of a handsome cut-stone structure.

Discovery in Solar Physics.

Professor J. M. Schaeberle, of the Lick Observatory, arrived in New York on June 24 from South America, where he had gone to observe the solar eclipse of April 16.

He set up his instruments near Merciditas, Chile. The big telescope was erected a month before the eventful day. Preliminary observations were then carefully conducted. The plates used with the large telescope were 18 by 22 inches. He had also a Clark equatorial with a 6 inch lens, a 6 inch Dallmeyer lens with a 3 foot focus, and two small cameras. On the day of the eclipse he made about fifty negatives of the corona. With the large telescope he made eight negatives, and they are larger than any that have ever been taken by any one of an eclipse. The big plates of the corona show the full length of the plates, and the details are brought out with great precision. The photographs taken with the smaller instruments are also valuable. He is confident that the theory he had before making the observations is sustained beyond a doubt. His theory may be thus stated :

The corona, which appears during every total eclipse, is caused by the fact that the sun was covered with immense volcanoes, which continually belched forth great masses of molten material, which the sun drew back to it with a speed which could not be realized. The mechanical actions seem to be shown plainly on the large photographs. Until the professor himself publishes in full the account of his observations it will be premature to discuss the influence which his discovery will have upon solar physics.

A Paper to Prevent Forged Documents.

It is very desirable that dishonest persons be prevented from duplicating certificates of stock, bonds, drafts, and such valuable documents: and many devices have been employed for this purpose. A new process has just been introduced in making a paper which will at least be difficult to imitate successfully. Ink is applied to a lithographic stone, and another similar stone is placed on its face and rubbed together until the ink is so distributed that a variegated design is produced. When the ink is dry, the design is transferred to paper after the usual manner in lithographic printing. Of course any color may be selected for the ink. It is manifest, also, that the design thus cheaply produced can be varied indefinitely until a pleasing or effective one is obtained. A counterfeit is detected at once when compared with a sample of the genuine paper.

Experiments with Rattlesnakes.

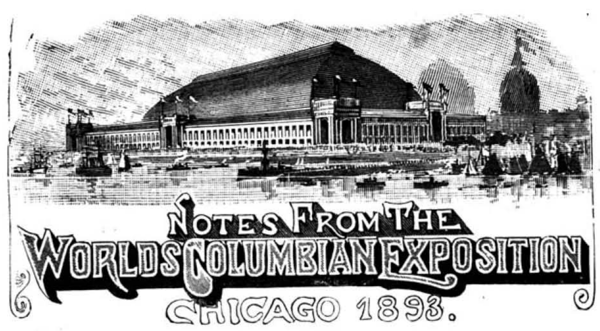
In the pathological laboratory of Johns Hopkins Hospital it was necessary recently to determine the exact action of the poison of the rattlesnake. The creatures were kept in a wire-covered box. When one was required for experimental purposes, it was caught round the neck by a noose at the end of a stick. A deep glass vessel was then presented to the enraged animal, and it instantly struck its edge with its fangs. The poison, which was caught in the bottom of the vessel, was free from all foreign admixture. Minute quantities injected beneath the skin of rabbits produced marked lesions. For some reason or other the snakes refused food, and in order to keep them alive an egg mixture had to be forced down their throat by means of a stout glass tube.

A New Use for the Tricycle.

A company has been formed in Milan for supplying the city with tricycles. At a trifling cost a person may hire one of these machines, to be had at certain defined places, and take a drive either for business or pleasure. Each tricycle has a driver, so that the hirer has nothing to do with either its propulsion or direction. The fare may depend upon the distance to be traversed or the time to be occupied by the journey. As to speed, it is believed the tricycle can go about twice as fast as the ordinary cab horse ; that is to say, if the payment is to be for a definite distance. But if the tricycle has been engaged by the hour, the speed, as a rule, is not remarkable. This system of local transit is on a par with the Japanese hand cart method or "rickshaw." The Jap vehicle is, doubtless, preferable to the tricycle.

Scientific Excursions.

The tenth geological expedition to the West has just gone out from Priceton College, under Professor Scott. The first of these useful enterprises set out, under Professor Brackett, in 1877, the second in 1878 under Professor J. B. McMaster, and all of the others under the present leader. In time it is hoped that a complete representation of American fresh water tertiary fossils may be obtained from the promising fields discovered in Colorado, Wyoming, Utah, Dakota, Oregon, and Montana. Hitherto the finds have been most encouraging. Immense numbers of extinct vertebrate specimens have been collected. Among the very important fossils may be mentioned the bones of a mesonyn, the only complete skeleton of the kind yet found, and the legs and pelvis of a three-toed horse.



The World's Columbian Exposition is now an "open fair" to a sufficient extent to satisfy the most radical. The gates are open for visitors at eight o'clock every morning and do not close until eleven o'clock at night, seven days in the week.

Near the Sixty-fourth Street entrance to the Exposition grounds are the exhibits of the Pennsylvania and of the New York Central and Hudson River Railroad companies. The New York Central exhibit is on the left. The building erected by the railroad company, and which forms a part of this exhibit, is much like a triumphal arch in architecture.

Two tracks of considerable length extend along one side of the building, and here are exhibited the latest models of car and engine building. One train consists of the famous engine 999, which holds the record for speed at the rate of 112 miles an hour. Attached to this engine is a train of three cars, comprising two day coaches and baggage and buffet car of the latest type, such as are used on the Empire State Express. On a short track on the side of this train, near the engine, is the famous old engine DeWitt Clinton, with the three passenger coaches attached. These two trains stand in the same relative position as illustrated in the SCIENTIFIC AMERICAN of May 13. On the track, at the left of the Empire State Express, is a train of five Wagner cars, fitted in the most magnificent manner. This train comprises the baggage and smoking car Columbus, the parlor car Pinzon, the compartment car San Salvador, the sleeper Isabella, and the dining car Ferdinand. In the car Columbus is a barber shop, bath room, library, etc. The Pinzon is finished mostly in white and gold, with the richest of silk draperies. The San Salvador has accommodations for sixteen people in the compartments, all of which are furnished in different colors. One compartment, called the bridal compartment, is most beautifully furnished. The Isabella is finished mostly in white mahogany, while the upholstering is in brocaded plush. This car, like the others and like the dining car Ferdinand, has the richest of silk draperies and every possible convenience. The entire train is lighted by electricity.

The exhibit of the Pennsylvania Railroad is contained in a building designed to represent a model passenger station of classic architecture. It contains a main hall 100 feet long and 40 feet wide, in which is displayed a collection of models, reliefs, maps, and illustrations covering a vast field of railroad topics and making in themselves a most valuable and instructive exhibit. There are many models of engines and cars used in the early days of railroading, and also models of stage coaches and wagons used before the railroad era; also models of canal boats and other early means of transportation. Among the models is one of the first trains run on the Camden and Amboy and the Philadelphia and Columbia Railroads. Among the models of cars is one of the old passenger car Victory, and of an emigrant car made over into an ambulance car to use in the hospital service during the war. The photographs and other illustrations cover an infinite variety of subjects connected with railroading. Among them are pictures of wrecks, of scenes at the time of the Johnstown flood and afterward, etc. Ferry transportation is illustrated by models of early types of ferry boats and of this company's latest and finest boat, the Washington. Methods of transferring freight cars across waterways are also illustrated.

Another set of models illustrates the advancement of modern block signal systems. Among the reliefs are two representing four centuries of progress in transportation, one dated 1492–1792, the other 1792–1892. Turning to the financial part of railroading, there is an exhibit that shows in a peculiar way the amount of money represented by this road. Silver dollars are laid on the top of sections of two rails, the dollars touching each other, and a placard explains that it would require as many silver dollars as could be laid on both tracks of 7,980 miles of road to equal the amount of money invested in this railroad. There are also four tracks on which is the outdoor exhibit. These tracks represent the standard adopted by this railroad. They are laid with steel rails weighing 100 lb. to the yard, with the latest type of frogs, switches, stone ballast, signals, etc.

All switching is done by the standard pneumatic interlocking switches and signals. On one track is shown the original locomotive John Bull put into service in 1831. This is believed to be the oldest locomotive in America. The two cars to which this locomotive is attached are passenger cars that were used on the Camden and Amboy road in 1836. The two cars which transported the large Krupp guns are also shown, each car with a model of a gun in place. One car with its load weighed 460,000 lb., the other 253,300 lb.

The Smithsonian Institution makes an exhibit in the Department of Ethnology in the Government building that gives an excellent idea of the physical peculiarities and modes of dress of the native peoples of this country and of Alaska. In a series of glass cases there are shown life-size models of these natives, each dressed in the manner peculiar to the tribe he represents.

It is a fact seldom appreciated that an Indian woman in carrying a child has the child strapped to her back looking in the opposite direction, while with the Esquimaux woman the child is so placed that it can readily look over the woman's shoulder. Rows of other cases contain large displays of the handiwork of these natives.

In the gallery is the Alaskan exhibit, where are shown samples of minerals, wares, and household utensils manufactured by the natives. Samples of grain are a revelation as to the richness of the soil in parts of this far-away corner of the United States. The most attractive features of the exhibit are the distinctively Alaskan wares, which reveal an unexpected skill among these people. Their carving in ivory, horn and wood is shown by many samples, and there are many pieces of metal work which show much ingenuity.

An attractive feature of the exhibit in the Leather and Shoe Trades building is a collection of footwear from all parts of the world, representing every conceivable type, some of them going back as far as the middle ages. Among the exhibits are specimens from China, Uruguay, Siberia, the Philippine Islands, Finland, the Caucasus, Australia, Sweden, Russia, Asia, Africa, South America, Mexico, Palestine, Jerusalem, Norway, Curacao, Japan and other countries.

Leather of nearly every conceivable kind and of all colors is shown in abundance. Among the more noticeable hides shown are a horse hide with the mane and tail intact, walrus hides which are from an inch and a half to two inches thick and an African elephant hide which weighs 800 pounds.

It is a misfortune there are exhibits in any of the galleries of the Exposition buildings. So much walking is necessary in order to inspect the various buildings that visitors hesitate about climbing stairs, and seem to be more willing to risk losing a chance to see attractive exhibits than to climb the stairs. It is late now to install passenger elevators to supplement the stair service, and it only remains to advise people to by all means see what the gallery in each building contains. Some of the rarest and most remarkable exhibits are located in the various galleries.

Informal gatherings are held in the rooms of the Associated Engineering Societies, No. 10 Van Buren Street, every Monday evening from 8 to 10 P. M. Visiting engineers and their friends are cordially invited.

HOW TO SEE THE EXPOSITION IN A WEEK.

The great majority of people who will visit the World's Columbian Exposition at Chicago will probably not have over a week at their disposal for sightseeing. With so little time as this it is an embarrassing question to decide how to best utilize it. There are probably one hundred buildings in the Exposition grounds and in the Midway Plaisance that every person attending the Exposition would find greater or less enjoyment in visiting. Besides this, there is a great deal of interest in studying the grounds, especially the landscape gardening. Besides these two things, which can easily absorb hours and days of time, there is another matter that should be borne in mind at all times, and that is the immensity of everything. Every visitor at the Exposition must consider these things, so as to save strength as well as time. A knowledge of the general plan of the grounds is necessary to accomplish this. Thus, suppose a man from Iowa should reach the Exposition grounds in the morning, determined to go to his State building and register and to then visit the Dairy. After registering, he asks the guard where the Dairy building is, and is told that it is in the southeastern corner of the grounds. If he take the most direct route in an effort to walk to this building, he would have to walk nearly three miles, whereas, were he to take the Intramural road, he could go almost from the door of one building to the door of the other in twenty minutes, at an expense of ten cents, thus saving a great deal of time and strength, both of which are important considerations.

It would be quite impossible to lay down a general rule for all people to follow in planning how to best utilize their week of time. Some people would wish to see everything; others would be content to see only certain specific exhibits. A mistake most liable to be made is for people to enter the first building they see after finding themselves in the grounds and to become so interested in this building that before they realize the situation the day has come and gone and they have seen only a part of one building.

No person visiting the Exposition can regret first of all taking a general view of the grounds. The Intramural road skirts the grounds in such a manner that a good idea can be obtained of the location of the buildings and the arrangement of the walks and promenades. The electric launches on the waterways approach all the buildings, and the round trip on one of these boats is not only a delightful trip, but it also adds greatly to one's understanding of the location of the buildings. Having made the trip on the elevated road, which is raised from twelve to twenty feet above the ground, so that the view is thus much more enhanced, and also having perhaps made the round trip on an electric launch, the visitor is ready for the work of studying the exhibits.

The safest place to begin is in one of the largest buildings, such, for instance, as the Manufactures and Liberal Arts building, which consumes at least a day. It would take another day to see what there is in the Electricity building, the Mining building, the Palace of Mechanic Arts and the Transportation building. The third day would be consumed in looking over the Agricultural building, the United States Government building, the Fisheries and other buildings. No one should fail to devote at least one day to the Gallery of Fine Arts. The remaining two days would cover a glance at some of the State buildings and foreign government buildings, to the concessions in Midway Plaisance and to a second look at exhibits which excited the most interest.

It would be a delightful study to take up as a subject the splendid exhibit made by Germany, and follow it from building to building until everything German had been seen. The same line of study would be particularly interesting in the Japanese exhibit, as also the French, English, and exhibits of other nations. But to attempt to divide the work in this way would result in the loss of at least half a day in going from one building to another.

In the gallery of the Fine Arts building Japan makes more of an exhibit than it does on the main floor. A visitor who neglects to see this Japanese art work in the gallery loses much, because the whole art exhibit of Japan is a revelation. It shows that these people possess artistic feeling, the existence of which the outside world has never fully appreciated.

The mechanically inclined visitor will find a feast for his eyes in the Transportation building, and more especially in the annex to this building, where there is a grand display of locomotives, American and foreign, old style and new style. In the gallery of this building are many smaller exhibits in the line of transportation and a particularly fine display of bicycles.

In the Mining building gallery are many displays of minerals equally as interesting as many of the displays on the ground floor. In the Electricity building there is more in the gallery that the average person will be interested in than there is on the ground floor, because exhibits in the gallery comprise mostly electrical devices rather than methods of generating electricity, to which the ground floor is mostly given up.

The gallery in the Manufactures and Liberal Arts building is given over almost wholly to liberal arts, and here one finds extensive exhibits which concern the education of the young. The ground floor of this building is given over to the department of manufactures, and here is exhibited in perfection the choicest of manufactures of all the leading nations of the world. A person cannot visit one of these exhibits without feeling in touch with the people and the nation making it and becoming interested in them. Japan makes a remarkably fine display of ornamental and artistic wares. Germany, Austria, France, Russia, Denmark, Norway, Switzerland, Italy, Spain, and, in fact, all corners of the world make exhibits of manufactures and wares each peculiar to themselves. The section occupied by Great Britain contains not only the exhibits from the British kingdom, but also a large and fine exhibit from Canada, and many choice exhibits from Australia and other British colonies.

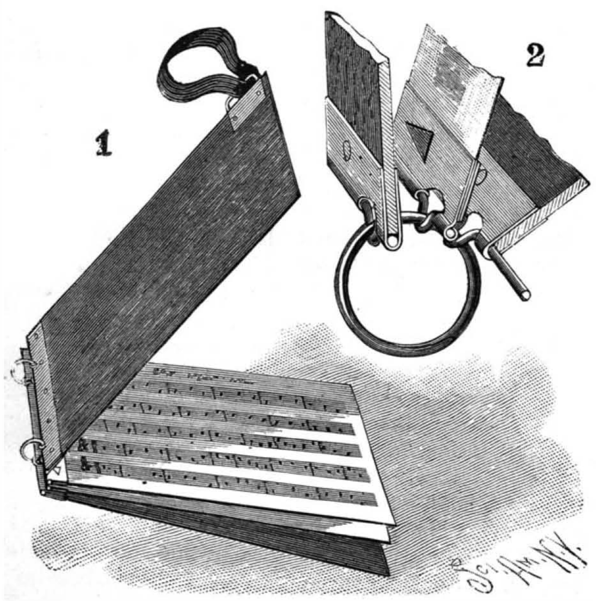
In the Agricultural building nearly every foreign nation makes an exhibit more or less pretentious. In the Palace of Mechanic Arts visitors are instinctively drawn toward the great power plant, where are engines aggregating twenty-five thousand horse power, many of the engines being in operation all the time. It is here that energy is generated to supply the electric lighting of the Exposition and to furnish in addition 5,000 or more horse power of electrical energy for power purposes. Then there is the Leather and Shoe Trade exhibit, the Forestry exhibit, the Dairy exhibit and many others not quite so large, but each interesting and instructive.

In connection with such a week's visit comes the question of expense. Seven days' admission to the grounds, at 50 cts. an admission, would amount to $3.50. An excellent lunch can be obtained at any one of dozens of restaurants in the grounds for a like sum or for less. It is a popular thing for people to carry lunch with them, and every day at noon thousands of people

(*Continued on page 26.*)

A MUSIC BOOK OR FOLIO.

The illustration represents a strong and cheap book or folio, made without the use of mucilage or glue. the covers of which are adapted to be folded back to back, and in which any desired number of sheets may be quickly and strongly fastened in place. The improvement has been patented by Mr. William H. Ayres, of Sackett's Harbor, N. Y. The covers are of board, having at their meeting ends strips of metallic binding, each strip being doubled over the edge of the board, while near opposite ends are eyes formed of wires, held in the loops of the strips. These eyes engage split rings, similar to the common key rings, and which serve as hinges for the covers; also serving as a means of attachment for the sheets of music held between the covers. The sheets are held at their ends between metallic strips, one of which has prods struck up from the body of the metal, to be passed through the sheets and through slots in an opposite strip, being then bent down upon the strip. One of the strips is adapted to hold in place a wire forming eyes adapted to engage



AYRES' MUSIC BOOK OR FOLIO.

the rings, as shown in the sectional view, Fig. 2, any number of the binding strips, holding sheets of music, being placed between the covers until the rings are full. On one of the covers, near its outer end, is a metallic strip carrying a keeper with an elastic band, which may be adjusted to fit over the end portions of the sheets and not obscure the music. The placing of music sheets in or the removing of them from this folio is readily effected.

THE MYSTERIOUS TRUNK.

A trick known by the name of the Indian Trunk, the Mysterious Trunk, the Packer's Surprise, etc., formerly had much success in theaters of prestidigitation. This trick, which may be presented in several ways, is consequently executed by different means, one of which we shall describe.

The following is in what the experiment consists: The prestidigitator has a trunk brought to him, which he allows the spectators to examine. When every one is certain that it contains no mechanism, a person comes upon the stage and enters the trunk. It is found that he fills it entirely, and the cover is shut down. A spectator locks the trunk and guards the padlock.

The trunk is afterward wound in all directions with rope, the intersections of the latter are sealed, and the whole is introduced into a bag provided with leather straps, and which may in its turn be sealed at each of its buckles. When the operation is finished, the spectators who have aided in the packing remain on the spot to see that nothing makes its exit from the trunk, which has been placed upon two wooden horses. The prestidigitator then fires a pistol over the trunk, which, when divested of its covering, ropes, and unbroken seals, is found to be entirely empty.

By what means has a human body been able to disappear without being perceived by the spectators who were constantly looking at the trunk, and, better still, by those who were handling it an instant before, and who still surround it?

The whole credit of the trick is due to the cabinet maker who constructed the trunk. The latter, in the first place, is exactly like an ordinary trunk, and the closest examination reveals nothing out of the way about it. Yet one of the ends, instead of being nailed, is mounted upon a pivot on the two long sides, so that it can swing. The swinging motion is arrested by a spring plate bolt. When the person in the interior presses upon a point corresponding to this bolt, the pivot becomes free and the end of the trunk swings.

The following is the way that the operation is performed in order that the spectators may not perceive the opening of the trunk. The operator's assistant takes his place in the trunk, which is closed and locked and the padlock sealed. Some obliging spectators then aid in tying the trunk, around which the rope is passed twice lengthwise, beginning at the side opposite the opening part. The rope is then passed over this part and runs in the axis of the pivots. Then the trunk, for the convenience of tying, is tilted upon the end where the rope passes. It is then that the assistant inclosed in the interior presses the bolt. The end of the trunk then has a tendency to open, and as the prestidigitator has taken care to tilt the trunk at a carefully marked point of the stage floor, the movable end meets in the latter with an exactly similar trap that opens at the same time, and it is through these two traps that the invisible vanishing takes place.

As soon as the assistant has passed through the trap, he pushes up the latter, and consequently the movable end of the trunk, which closes upon its spring plate bolt.

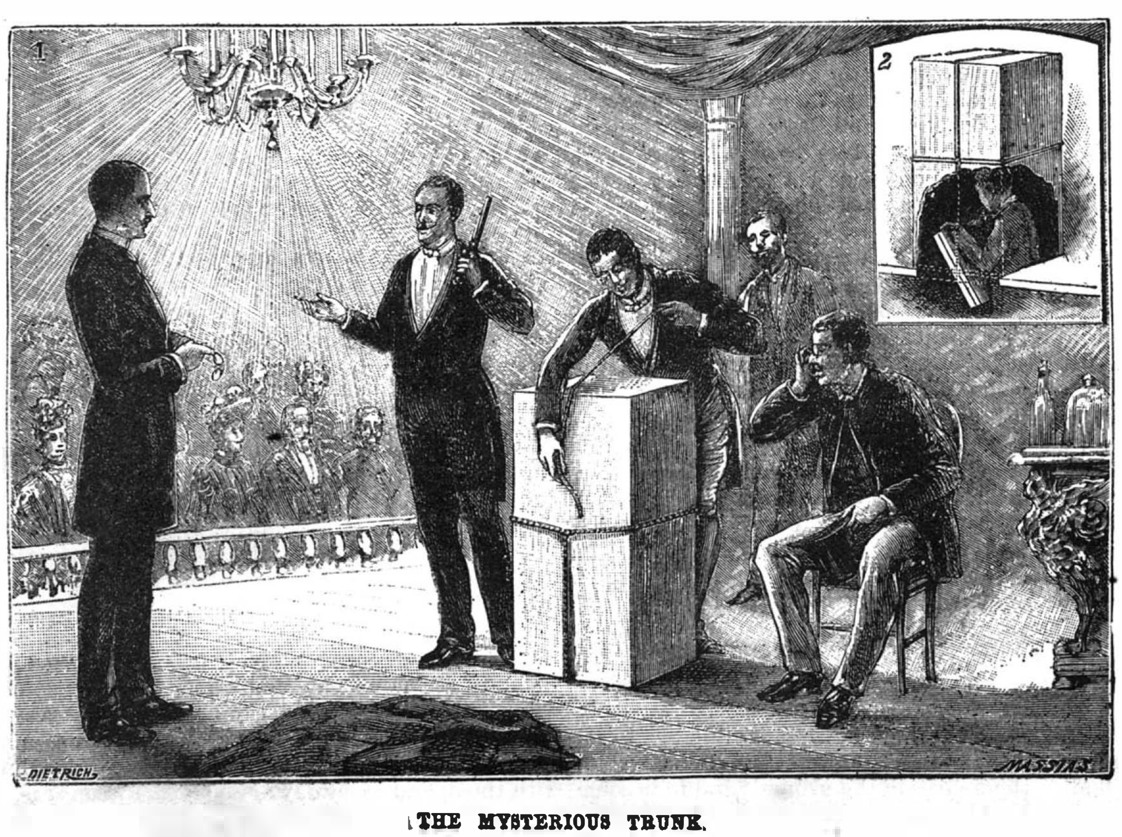
The time that it takes the man to pass through the trap is insignificant, and while the ropes are being crossed the operation might be performed several times. Afterward, there is nothing to be done but to proceed with the experiment as we have said, care being taken, however, not to abuse the complaisance of the spectators, and not to allow them to try the weight of the trunk.

When the vanished person descends beneath the stage, he is supported by some other individual if the theater is not well appointed, and by a trap with a counterpoise if the construction of the stage admits of it. This trap permits of expediting things in certain cases of the reappearance of the confederate, but is useless in the process described above.

Such is one of the artifices employed. Whatever be the process, the presentation of it is often complicated by causing the person who has vanished to reappear in a second trunk that has previously been ascertained to be empty and that has been sealed and enveloped under the eyes of the spectators. It will be easily comprehended that the operation here is inverse to that of the first, and that the confederate beneath the stage awaits the proper moment to be lifted into the interior of the second trunk, whose movable end is opened outwardly by the prestidigitator at the desired moment.

Boxes with glass sides also have been constructed. The management is the same, but, as the person inclosed is visible up to the last moment, care must be taken to so pass the ropes as not to interfere with the trap of the trunk, which then consists of one of the sides, and which operates at the moment when the trunk, bound with ropes, sealed and laid upon this side, is about to be wrapped up.

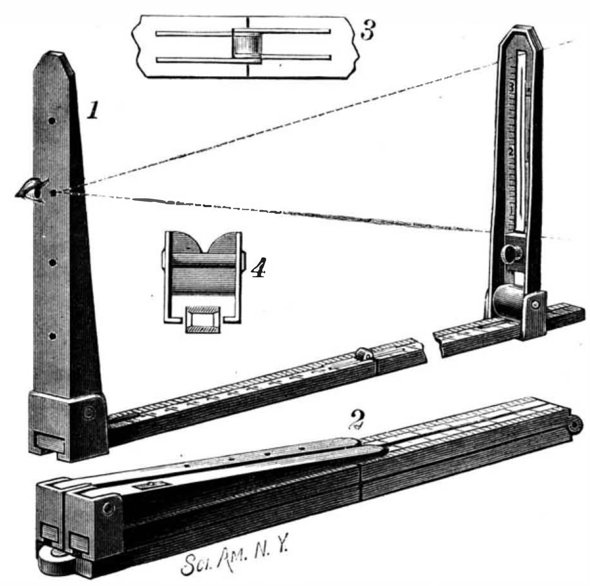
This presentation has still more effect upon the spectators than the preceding, and seems to present greater difficulties.—*La Nature.*



THE MYSTERIOUS TRUNK.

AN INSTRUMENT FOR MEASURING DISTANCES.

This compactly folding instrument for measuring linear distances and vertical heights is styled by the inventor a "metroscope." It has been patented by

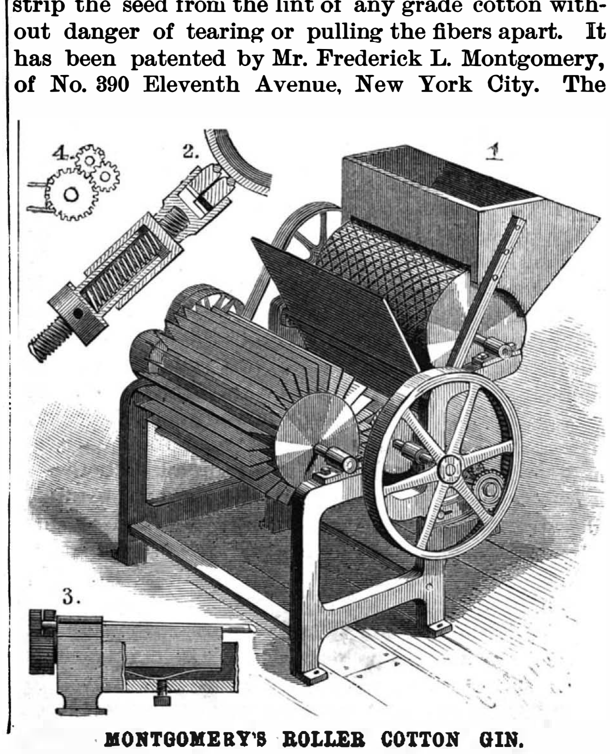


BAILLIE'S "METROSCOPE."

Mr. James L. Baillie, of Shawnee, Ohio, and is also adapted for use in drawing or painting, enabling the artist to produce the principal objects in exact proportional sizes. Fig. 1 shows the manner in which the instrument is used, Fig. 2 showing it folded, and Figs. 3 and 4 illustrating the construction of the hinge. A rule of the usual kind is employed, preferably an ordinary pocket rule, to afford a base or support for the height and distance measuring devices. Besides the usual middle hinge, it has other hinges to enable the members to be folded at right angles, these hinges being made narrow, occupying only the middle portion of the members, and permitting the slide to pass by them. A slide whose back supports uprights is mounted on each end of the rule, one of the slides carrying a vertical scale having a central longitudinal slot at one side of which the marks represent hundredths, while on the other side they represent inches and tenths of inches, showing the distance when using a ten foot pole. The other slide carries a sight plate having peep holes in the vertical plane of the slot in the first upright, the operator peeping through one of the holes and through the slot to the object sighted. A slide held to move on the scale may be fixed in any desired position by a set screw.

AN IMPROVED ROLLER COTTON GIN.

This machine is designed to quickly and thoroughly strip the seed from the lint of any grade cotton without danger of tearing or pulling the fibers apart. It has been patented by Mr. Frederick L. Montgomery, of No. 390 Eleventh Avenue, New York City. The



MONTGOMERY'S ROLLER COTTON GIN.

feed drum beneath the hopper has the usual roughened surface, as may be seen in the perspective view, Fig. 1, and opposite the drum is a transverse feed table guiding the cotton down to the ginning roller, there being a second feed table, at an opposite angle, below the feed drum. The ginning roller, on the main driving shaft, is covered with leather or other elastic material, and on its periphery are held two rollers, one a knife roller to separate the seed from the lint, and the other to press the lint to the drum while the seed is being removed. The rollers are small shafts extending the entire width of the ginning roller, Fig. 2 being a central transverse sectional view, and Fig. 3 a front view of the rollers and their bearings, Fig. 4 showing the gearing by which they are driven. Each section of the bearing is pressed on at its underside by a spring, whose tension may be regulated by a set screw, to hold the rollers in proper contact with the ginning roller. Both rollers are so supported by their bearings that they will be prevented from spreading, and will be held uniformly against the surface of the ginning roller throughout their entire length, while the yieldingly mounted boxes carrying the rollers permit a heavier or lighter bunch of cotton to pass through, while preventing any seed from passing the same way. The knife roller revolves in the same direction as the ginning roller, but it is geared to revolve at a much higher rate of speed, and in front of it, directly below the lower feed table, is a discharge table, over which the seed separated from the lint is delivered to one side of the machine. The lint adhering to the covering of the ginning roller, after passing the small rollers, is removed by a stripper cylinder which acts as a brush.

SURFACE TENSION.*

The existence of surface tension is shown by the following simple experiments: (1) Two round pencils, made of light wood, and not more than ¼ inch in diameter, are placed in contact one on the other in a horizontal position. Place between the two pencils several drops of pure water, so that all of the line of contact is well moistened. In a little time, a quantity of water will adhere to both pencils, which will take a concave, curved shape, a cross section of which is shown in Fig. 1. The lower pencil, in consequence of the tension of the concave surfaces, *a* and *b*, on opposite sides of the line of contact, will be suspended from the other pencil. The adhesion is strong enough to admit of moving the pencils about. (2) Clean a copper ring made of wire about $\frac{1}{25}$ inch in diameter and having a diameter of 2½ or 3 inches. Lay the ring carefully upon the surface of very pure water, contained in a well-washed glass vessel, as shown in Fig. 2. The ring will float in spite of its specific weight. Needles, quicksilver globules, thin rings of platinum, etc., may also be made to float upon the water. (3) Take a sheet of light but not glossy paper, about 5 or 6 inches long and 3 inches broad, and turn down upon all four sides a margin about 1 inch broad. Then lift up these edges and form a box 1 inch high as shown in Fig. 3. Place the box upon a table, and moisten by means of a brush all the inner surface, then pour water in to a depth of ¼ inch. The tension of the surface of the fluid will cause the opposite long sides of the box to approach each other, and the little paper box will close on itself. (4) Take a cylindrical cork having a diameter of ⅜ inch and a length of ⅝ inch, and in the middle of one end of the cork insert a fine iron wire, from 2 to 2¼ inches in length, provided with a hook, on which is placed a little basket to receive the ballast. Upon the other end of the cork is fastened a frame, which consists of a fine iron wire ring 3 inches in diameter, and two pieces of the same wire are inserted in the cork so as to support the ring perpendicular to the axis of the cork and concentric with it. Plunge this little instrument in water contained in a vessel of sufficient depth. If the weight in the vessel is suitable the cork will be held in a vertical position, and only project a short distance above the surface of the water. If the whole apparatus be pressed down vertically in the water until the ring is submerged, as shown in Fig. 4, the ring will not leave the water, being held by the surface tension of the water, but will rise a little above the water level, and the water will take the form of a concave meniscus. To liberate the ring so that it will rise up out of the water apparently by a free impulse, and allow the system to regain its first position of equilibrium, let fall a drop of ether upon the water. This will decrease the surface tension, when the buoyancy of the cork will lift the ring above the water. (5) Dissolve 1¼ oz. of Castile soap and 1¼ oz. of crystalline sugar in a quart of water. In this plunge a square bent from small slender iron wire, and draw it out again. It will be filled with a thin film of the liquid. Lay upon this film a loop of silk thread, as shown in Fig. 5. It will form an irregular outline. If the film be perforated within the silk loop, the thread will suddenly form a complete circle.

* From the German translation of "Experimental Science."

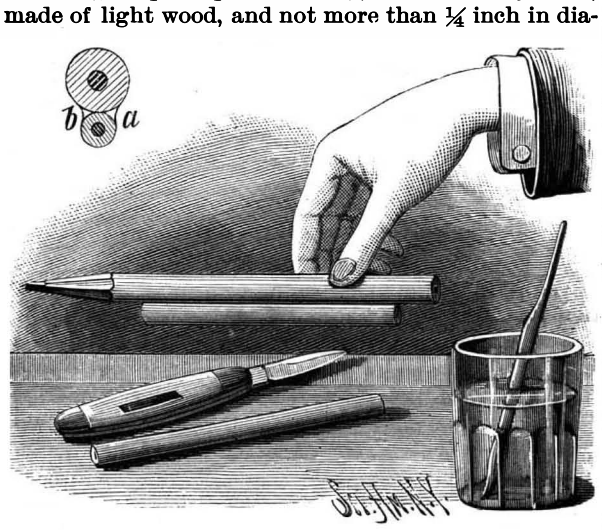


Fig. 1.—EXAMPLE OF SURFACE TENSION.

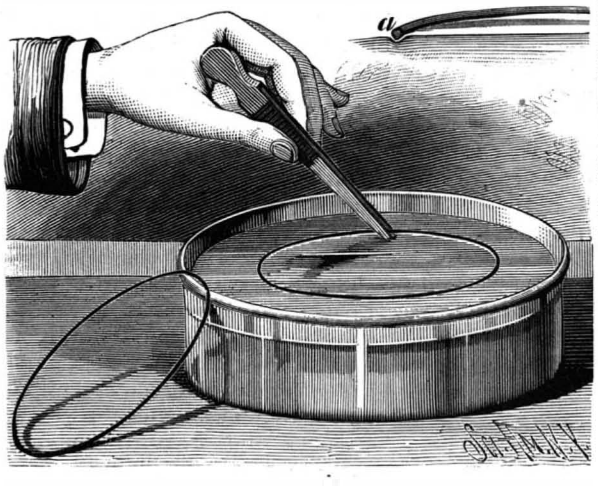


Fig. 2.—FLOATING RING.

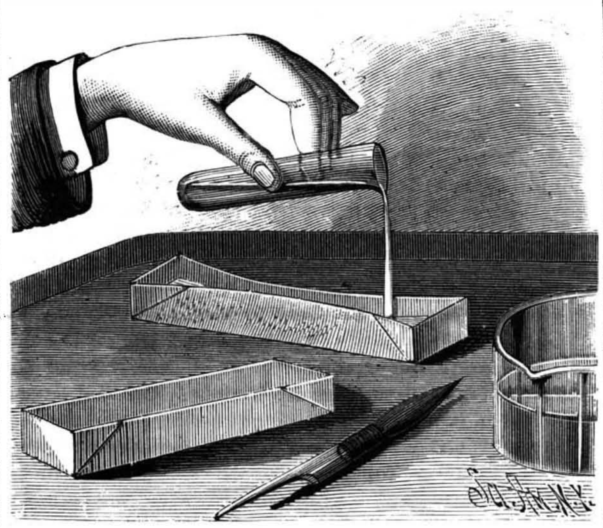


Fig. 3.—DISTORTION BY SURFACE TENSION.

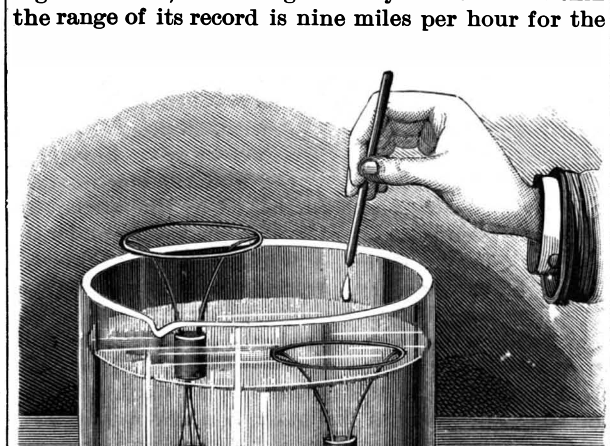


Fig. 4.—FLOATING AND SUBMERGED RINGS.

Fig. 5.—TENSION OF SOAP FILM.

Horse Power of Windmills.

According to observations of the United States Signal Service, the average velocity of the wind within the range of its record is nine miles per hour for the year along the North Atlantic border and Northwestern States, ten miles on the plains of the West and six miles in the Gulf States. It is a well-known fact that the pressure of the wind increases as the square of the velocity, and from observations a ten-mile breeze has a pressure of 0·492 pound per square foot of surface exposed to its force, a fifteen-mile breeze equals 1·107 pounds and a twenty-mile (brisk wind) has 1·968 pounds pressure per square foot.

The horse power of windmills of the best construction is as the proportional squares of their diameters and inversely as their velocities; for example, a ten-foot mill in a sixteen-mile breeze will develop 0·15 horse power at sixty-five revolutions per minute. A twenty-foot mill with the same breeze and at forty revolutions per minute will develop one horse power; a twenty-five-foot mill, thirty-five revolutions, one and three-fourths horse power; a thirty-foot mill, twenty-eight revolutions, three and one-half horse power; a forty-foot mill, twenty-two revolutions, seven and one-half horse power; a fifty-foot mill, eighteen revolutions, twelve horse power.

The increase in power from increase in velocity of the wind is equal to the square of its proportional velocity, as, for example, the twenty-five-foot mill rated above for a sixteen-mile wind will with a thirty-two-mile wind have its horse power increased by $\frac{22}{16}=2^2=4\times1\frac{3}{4}=7$ horse power; a forty-foot mill in a thirty-two-mile wind will run up to thirty horse power, and a fifty-foot mill to forty-eight horse power, with a small deduction for increased friction of air on the wheel and the machinery.

The modern mill of medium and large size will run and produce work in a four-mile breeze, becoming very efficient in an eight to sixteen mile breeze, and increase its power with safety to the running gear up to a gale of forty-five miles per hour.

It has been often asserted that one of the great drawbacks to the general use of windmills for other than the exclusive pumping of water is the fact that when most needed the wind is at fault. This may be ever so true, but the fact that they have been so used for centuries and are largely now in use for milling purposes does not make them of less value in the view of the storage of twenty-four hours' work of the wind for a six to ten hours' output of power at the required time.

For mechanical work that can be carried on only during the ordinary ten-hour day this becomes a serious inconvenience; but as such power is always available from five to eight hours and often twelve hours in the twenty-four, a means of storage and transmission of power at any time to the time and distance required for use should be the proper recourse for rescuing an intermitting power from this difficulty, and thus make possible a uniform power of ten hours for an intermitting power of twenty-four hours.—*Iron Age.*

Cement for Rubber and Leather.

No. 1.

Carbon bisulphide	4	ounces.
India rubber in fine shreds	1	ounce.
Isinglass	2	drachms.
Gutta-percha	½	ounce.

Put a thin coating of the solution on the parts, allow to dry, heat to melting, place the parts in close contact, and hammer out all air bubbles.

No. 2.

Gutta-percha	16 ounces.
India rubber	4 ounces.
Pitch	2 ounces.
Shellac	1 ounce.
Linseed oil	2 ounces.

Mix together and melt by a gentle heat.

Cleanliness the First Law of Health.

The following words of the late Dr. Richardson should be ever kept in mind: "Cleanliness covers the whole field of sanitary labor. Cleanliness, that is purity of air; cleanliness, that is purity of water; cleanliness in and around the house; cleanliness of persons; cleanliness of dress; cleanliness of food and feeding; cleanliness in work; cleanliness in habits of the individual man and woman; cleanliness of life and conversation; purity of life, temperance, all these are in man's power."

OIL FUEL AND BOILERS AT THE GREAT EXPOSITION.

(*Continued from first page.*)

These boilers, with the exception of one Campbell & Zell and the three Climax, are arranged in batteries of two. Each pair of boilers feeds steam into one common pipe which delivers into the 36-inch steam headers under the gallery floor. Of these headers there are seven; five in the main boiler plant and two in the annex, the longest being 150 feet in length. The headers are connected by pipes ten inches in diameter, except that between the main boiler plant and the annex, which is twelve inches in diameter. These connecting pipes are arranged with elbows and nipples to allow for expansion. The expansion in so large a system is considerable. If the header had been made in a single piece, the expansion in the 800 feet in length would have been about twenty inches. Such an amount would have been utterly unmanageable. By means of the connecting pipes the same effect is produced as though there were but a single header. The main headers are securely fastened in the center to large masonry foundations. They are further supported every few feet by rollers placed on foundations of masonry. These rollers permit the headers to expand freely in each direction.

A four-inch drain pipe runs the whole length of the boiler plant and discharges into a large tank outside. The headers are connected with three two-inch drain pipes, so that in case of emergency, if a battery of boilers should get to foaming, for instance, they can be quickly emptied. The water of condensation is carried back into the boilers by Westinghouse loops. The Westinghouse loop is simply a pipe carried from the bottom of the header up some distance above the top of the boiler, thence across to the rear of the boiler house, down below the water line, and then into the boiler through an ordinary check valve. The height of the vertical pipe is so calculated that the weight of the column of water in it added to the pressure in the header, which, of course, is somewhat less than the boiler pressure, shall be sufficient to overcome the excess of pressure in the boiler, and so carry the water of condensation and entrained water through the check valve and into the boiler. Water glasses are placed on the headers, so that if water should accumulate by any chance, it can be readily discovered.

The boilers are fed by pumps and injectors of various makes, all being listed as exhibits. The Abendroth & Root boilers are fed by means of six Watson injectors and two Deane pumps, 7½x4½x10 inches. The Gill boilers are fed by two Korting injectors and two Barr pumps, one 10x6x12 inches, the other 10x6x10. The pumps supplying these boilers are regulated by a Thomas automatic feed water regulator, which keeps the water at a constant level without the intervention of an attendant. The Heine boilers are supplied by eight Penberthy injectors, two Knowles pumps, 10x5x12, and two Blake pumps, 8x5x12. Four Hayden & Derby injectors and two Davidson compound pumps 12 and 20x10½x20 are required to supply the National boilers. The Zell boilers are supplied by six Nathan injectors, one Cameron pump, one Laidlaw & Dunn 7½x4½x10, one Wilson Snyder 14x8x18, one Canton, one Worthington and one Boyts Porter pump. The Babcock & Wilcox boilers are supplied by Hancock inspirators and three by Snow pumps. One is compound 8 and 12x7x12, the others are 10x5x10 and 8x5x10, respectively. Two Buffalo pumps 10x6x10 and 7½x5x8 and one Gould pump run by an Ideal engine and Schaefer & Budenberg injectors are used to feed the Stirling exhibit. In the annex two Marsh pumps supply the Heine boilers. The Climax boilers are fed by one Blakeslee and one Smedley, and the Stirling boilers are supplied by one Hall and one McGowan pump. Thus intending purchasers or any one interested in power plants may see most of the leading injectors, inspirators and pumps in practical operation and judge of their relative merits for himself.

On every make of boilers is a feed header into which the pumps of those boilers deliver. From this header separate pipes are run into each boiler.

Oil is the fuel used. The oil is atomized by a steam jet as it is discharged from the burner into the furnace. The various makes of oil burners are shown in operation. Any one interested in comparing the various makes will find twelve Reid burners under the Abendroth & Root boilers, sixteen under the National, and forty-six under the Campbell & Zell; thirty Larkin burners under the Babcock & Wilcox and twenty-eight under the Climax; sixteen Arms burners under the Gill boilers. The Heine boilers use seventeen Graves, sixteen Burton, eight Wright, and twelve Reid burners; the Stirlings use eight Burton and eight locomotive burners. The oil is fed from an oil vault half a mile from the boiler house. Two mains run from this vault into a five-inch header which runs the entire length of the boiler house. This header is tapped frequently, and every make of boilers is supplied through a separate pipe. The pressure, as allowed by the underwriters, is six pounds. Running along the tops of the boilers from one end of the boiler house to the other is a two and one-half inch steam pipe, with valves between each make of boilers. A two-inch steam pipe feeds into this from each boiler. From this two and one-half inch pipe, steam is carried into the oil burners for atomizing the oil. As steam is necessary to burn the oil, the pipe obviates the necessity of using wood to start up any battery of boilers after it has been allowed to cool down, so long as any other battery has steam up. The Gill and the Campbell & Zell boilers have independent steam connections with the burners in addition.

The safety valves, which are the ordinary pop valves, are set at 125 pounds.

The entire room is in charge of George Ross Green, who is known as the superintendent of the boiler house. His rank is that of second assistant engineer. Each exhibitor furnishes firemen and water tenders to care for its boilers. They work in watches of eight hours each, one or two men being required, according to the number of boilers in the exhibit. In addition, the Exposition furnishes a gang of thirty men under three foremen, who look after cleaning, oil, and oiling, repairs, alterations, and so on. One man's duties consist in watching for smoke and promptly reporting any offense in this particular. He sits in a little house back of the boiler room, where he has a clear view of all the chimneys. Electric communication with every furnace is provided, so that as soon as a chimney begins to smoke the fireman is warned by a bell to look after the matter. Another man looks after the valves, of which there are 108 on the headers alone, and a grand total of 1,200 in round numbers in the boiler house.

Mr. Green has devised an ingenious yet simple scheme for keeping a record of the condition of the boilers and engine. On the north wall of the boiler house, near the east end of the gallery, hang two huge blue prints. On one is a diagram of the boiler house and machinery hall showing the location of every boiler and engine, each being numbered. The key to these numbers is given on the bottom of the blue print. A brass peg is screwed into each spot occupied by a boiler or engine. At one corner are stacks of red, white, and black tags about half an inch wide and two inches long. A white tag hung on a peg indicates that that particular engine or boiler is working; a red tag shows that the boiler or engine is hot and ready to be put in operation at a moment's notice; black shows that the engine or boiler is not in use for some reason. Whenever an engine or boiler is started or stopped, the foreman on duty goes to the diagram and hangs a suitably colored tag on the peg which stands for that engine or boiler. Thus the record is constantly kept up to date. On the second blue print is a diagram of the headers and header valves with similar pegs and tags. Whenever a request is made for steam for an engine the foreman in charge sends the valve man to open the valve and hangs a white tag on the proper peg to show that it is open. In changing watches the foreman coming on duty can see at a glance just how things stand. This saves a vast amount of labor in making out lengthy reports at the end of each watch.

An elaborate record is kept in the boiler room showing when each boiler is started up, when shut down, when valves are opened and when closed, the steam pressure, furnaces that smoke, repairs made, and so on.

Failure of the East End of the Great Austin Dam.

A serious break has occurred in the great dam at Austin, Texas, which was recently completed. The massive masonry inclosing the penstocks gradually went down at the east end, making a great crack in the wall where it leaves the top of the dam. The granite wall inclosing the wheel pits was swept away. Several of the pits were utterly destroyed, and the machinery in them tossed about and carried off by the force of the roaring torrent sweeping through the cavern under the penstock level. Water is working its way through nearly all the masonry surrounding the penstocks, and it will be a total loss. Some of the large penstocks and machinery have been injured, and a conservative estimate places the loss to the city at $200,000. It appears now that the plans of Engineer Frizell, who had charge of the work from its inception, but who was relieved before its completion, were not carried out, and the masonry failed to be extended into the east bank some fifty feet to a point designated by him.—*N. O. Times-Democrat.*

The Campania.

The average speed of the new Cunard steamer Campania on her last trip from Liverpool to New York was as follows:

	Miles.
June 19	509
" 20	548
" 21	521
" 22	494
" 23	532
" 24	260
	2,864

Correspondence.

Remedy for Ivy Poison.

To the Editor of the Scientific American:

In your issue of June 17 some one signing himself H. M. suggests a cure for *Rhus tox.* or poison ivy. He describes its effects, as myself and others can testify, who have been so unfortunate as to come in contact with it. He prescribes pills and promises relief after taking a few doses, or after a few days. Bean leaves bruised and applied will afford instant relief and arrest any further progress of the affliction. I have found a decoction of dried bean leaves quite as satisfactory; so that the prudent may always have the remedy, summer or winter. J. A. PALMER.

Plymouth, Ind., June 22, 1893.

Bright Gold Patented in France.

To the Editor of the Scientific American:

The facility with which a patent can be obtained in France has often been commented upon. A most striking example of recent occurrence has just come under my notice. The long known liquid bright gold has just been patented in France to a Mr. Pertsch, whose process consists in the treatment of balsam of sulphur with the chloride of a precious metal, thus obtaining a resinous compound of the precious metal suitable for china gilding, etc.

The very same process was used as far back as 1830 by the chemist Kuehne, at Meissen, Saxony. It is described in Dingler's *Polytechnisches Journal*, of 1861, and a French patent was issued for it, in 1851, to Dutertre Brothers, of Paris (*vide Bulletin de la Societe d'Encouragement*, March, 1861). Nevertheless, a new French patent has just been granted for the same process to another party. Your own "Scientific American Cyclopedia of Receipts" gives, on page 231, under "Gold Luster for China Painting," the principles of this "new" patented process. P. M.

[In France patents are granted to every applicant whose papers are in proper form, without official examinations as to the novelty of the invention, and the patent holds good if the invention is new, but not otherwise. Applicants make their own examinations. —ED. S. A.]

Electroplating Ships' Bottoms.

To the Editor of the Scientific American:

In an article on "The Maintenance of the Speed of War Ships," in June 3 SCIENTIFIC AMERICAN, you conclude: "But invention has not yet reached the point of adequately protecting a ship's bottom from barnacles and seaweed."

What is the matter with electroplating them with copper? The first expense, of course, would be great; but the actual cost of plating a large ship after the first expense for solutions, dynamos, and a suitable drydock would not be excessive.

At first glance there are other objections that appear. The difficulty of keeping a large surface of iron clean until the first coat of copper could be deposited is one. This can be overcome by a plan I used to keep the surfaces of the iron columns for the Philadelphia Public Buildings clean. They had each a surface of about 300 square feet, but after being pickled and freed from rust and scale, there was no trouble in keeping the exposed iron surface clean and free from oxide until such time as they could be got into the plating tank, and as they weighed about six tons, this took some time.

Another objection is that copper deposited from a solution of sulphate of copper always contains pin holes, which, of course, would admit the sea water and set up galvanic action between the copper and the iron of the hull. Also that the surface of the deposited copper would be rough, and thus interfere with the sailing qualities of the ship. These objections I have overcome by the use of a new plating solution that deposits copper in a much finer and more dense state than that deposited from the ordinary sulphate solution. Copper deposited from this new solution is entirely free from pin holes, and the surface, no matter how thick the coat, is perfectly smooth. It also adheres much better than ordinary plating, which is of great advantage, as there will be less danger of its being torn off by the accidental grounding of the ship in a sand bar.

In fact, there would be little danger of the copper being torn off anyway, as copper, when properly deposited on a clean iron surface, adheres very firmly, and nothing short of striking a rock or other equally hard obstruction would injure it. J. D. DARLING.

Philadelphia, Pa.

A Submarine War Boat.

The board of ordnance experts who have been considering the proposals and plans for the submarine boat, find only two of the plans suitable. It is thought one of these will be accepted by the Navy Department. All the bids came well within the appropriation of $200,000, and it is believed that one of the offers of $135,000 will be accepted and the boat built.

PARSONS' HOROLOGICAL INSTITUTE.

It is comparatively a short time since the manufacture of watches began to be carried on extensively in the United States, although the "Yankee" clock has been well known the world over for many years. While timepieces of foreign make were mainly sold and used, the watch repairer needed peculiar fitness for his work, which could be acquired only by long apprenticeship and familiarity with the various types of timepieces. When American watches became popular, watch making as a trade began to decline. Materials of every description became plentiful, easily obtained and readily used, and any difficult job was naturally turned over to the manufacturer. Still these conditions, as regards American watches, afforded no reason why watchmakers should degenerate. On the contrary, every improvement and modification of timepieces and every additional form of movement calls for higher skill in handling these delicate machines.

MRS. LYDIA BRADLEY.

Recognizing these facts, Mr. J. R. Parsons, of La Porte, Ind., started the La Porte school for watchmakers, the development of which was so rapid as to render it difficult for the founder to keep pace with the requirements. After the success of the school had been assured, several offers of considerable sums of money were made to remove the school to other places. At this time Mrs. Lydia Bradley, of Peoria, Ill., offered to provide a fine building, with all the tools and appliances necessary, for the use of any number of deserving young men and women who wished to learn a trade; and through her agents, Mr. W. W. Hammond and Mr. F. F. Ide, arrangements were made for the purchase of a large watch factory building in Peoria, Ill., with all its tools and machinery. The school was removed to these new quarters and started afresh, with the building and apparatus paid for and plenty of money to insure the success of the enterprise. The school was not only fortunate in being placed in such ample quarters, with sound financial backing, but also in securing the services of Mr. F. F. Ide, whose mechanical knowledge and skill have proved a valuable acquisition.

The object of the institute is not to make money, but to turn out competent watchmakers and jewelers. The tuition is only sufficient to make the institute self-supporting. We understand the attendance is very large, nearly equal to that of all the other schools of the kind combined. The institute gives the student a thorough education in horology, including instructions in making watches, chronometers, clocks and horological machinery in general and repairing the same. It gives a course in optics, and in this department graduates receive a separate diploma. Ladies are admitted to the institute on the same terms as gentlemen, and the list of students includes the names of a number of ladies who are taking the course, as well as some who have already graduated.

To acquire a thorough knowledge of watch making requires a certain amount of time, which cannot be shortened without detriment to the student. Long experience has shown that the length of the course in Parsons' Horological Institute is sufficient for imparting a thorough practical knowledge of the subject, and it has also shown that a shorter term is not advisable.

One of our engravings gives a clear idea of the buildings of the institute, while another shows a room devoted to practical watch making.

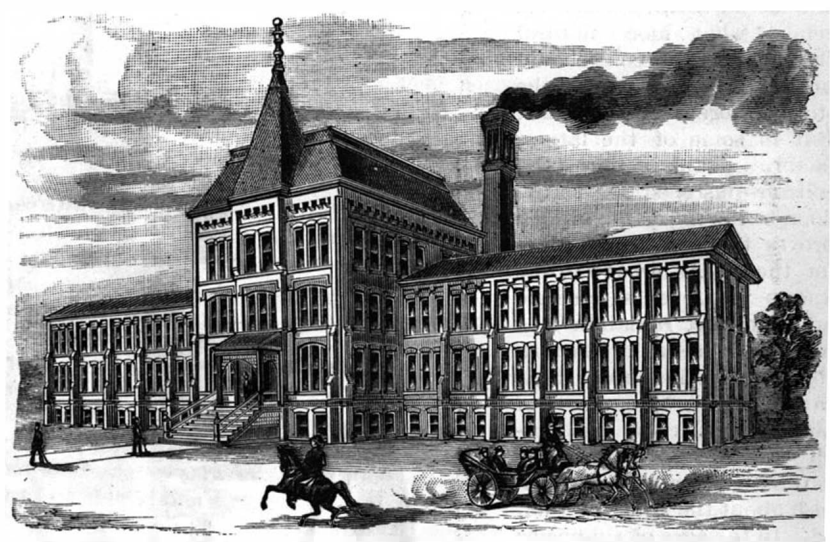
PRACTICAL WATCH MAKING.

MAKING wrought iron pipe direct from bars is the process recently started in a rolling-mill at Stubenville, O. If it works it means a complete change in pipe manufacture.

Electric Root Grubber.

Grubbing is the term for pulling up tree stumps by the roots, and this operation is now being accomplished at Otford, in Kent, by electricity. The inventor of the electric grubber is Mr. Freeman, whose Invicta Works are very pleasantly situated at Otford, on the River Darenth, the water of which in passing yields the necessary power for driving the generating plant, as well as the many other machines connected with his business. This business is a varied one, as the proprietor says "there are few jobs turned away, and the more out of the way they are, the better we like them, as yielding greater interest and profit." The works are unpretentious, Mr. Freeman having taken them as an old, ruinous, and dilapidated flour mill, simply on account of the water power, which is now being turned to such interesting and profitable use. The lighting machine is a small Gramme of the old type, installed some four or five years since, during which time it has done good service. A second generator is used for experiments in electrical plowing, thrashing, etc. Mr. Freeman is an enthusiast in these matters, and thinks electric agriculture has a great future before it, as it will undoubtedly prove itself to be more efficient and economical than either horse or steam power as at present applied, saving the carting of all coal and water, and where water power can be turned to account being very much less for running expenses.

The third dynamo, giving fifteen to nineteen kilowatts, is used for generating current for supplying the grubbing apparatus at the top of the Polhill, some two miles distant. It requires about twenty-five horse power to drive it at its maximum, although not more than one-third of this is usually required. The current is taken by overhead wires on telegraph poles to the motor on the grubber carriage. At the top of the hill several acres have been already grubbed. The ground is being cleared for the purpose of constructing one of a series of large forts for the protection of London. The motor drives, by means of belting and suitable gearing, a capstan upon which is coiled a few turns of a very strong steel wire rope. A heavy chain is attached to the tree roots, and as the motor is set to work and the rope exerts its force, the roots come up quietly one after the other. The installation is an interesting example of the application of electric power to country work.—*Elec. Eng., London.*



PARSONS' HOROLOGICAL INSTITUTE.

Items from "Science Gossip."

In the last number of the *Journal of the Royal Microscopical Society* there is an elaborate paper by Mr. C. H. Gill, giving the natural history of a parasite on diatoms. Diatoms are prettily shaped, prettily marked, single-celled plants, with a silicious or glassy skin. In this instance the host plant is only the three-hundredth part of an inch in length, but, minute though it be, it has a parasite all to itself, of course infinitely smaller, and Mr. Gill has carefully worked out its life history in his paper, which is illustrated by nine photographs, showing the different stages of the parasite's development.

At the last meeting of the Royal Society, Professor Dewar stated he had succeeded in freezing the atmosphere into a clear, transparent solid, although at present it has not been sufficiently proved whether the mass was a jelly of solid nitrogen containing liquid oxygen or a true ice of liquid air into which both these well known gases have been equally solidified.

Professor Crookshank recently gave a lecture on "Bacteria" (the microscopical funguses we have hitherto regarded as only baleful, but which are actually among mankind's best friends). One great group produces fermentation, so that without them we should have neither wine nor beer. Another division is the cause of organic decomposition, among which must be reckoned the nitrifying bacteria of the soils. If it were not for the latter group every animal that died would be as indestructible as an Egyptian mummy, inasmuch as the art of "mummifying" consisted in keeping away the decomposing bacteria. If it were not for the latter the surface of the earth would be piled with dead bodies, stacked in heaps or choking the rivers; not only that, but in time all the elements capable of building up living bodies would be used up—locked up in these corpses—and life would cease for lack of material to support it. The greatest enemies to this class of bacteria are the undertakers!

Jupiter is thirteen hundred times larger than the earth, so we take a great deal of interest in it, and its careful study of recent years has thrown a great deal of light upon the history and manufacture of worlds. One of the keenest astronomers, who was taking special charge of this huge globe, is Professor Pickering, the distinguished American scientist. In order to study the planet more definitely he has been residing on the top of Arequipa, in Peru, on account of its clear and cloudless atmosphere. He writes from there to state that the surface of Jupiter seems to consist of a uniform white mass of cloud, over which is stretched a gauzy and thin veil of brown material. The well-known belts of Jupiter, he says, are simply dense masses of this thin brown material, and the white spots merely holes seen through it. The most remarkable thing about Professor Pickering's observations concerns the moons or satellites of the planet. He has arrived at the conclusion that Jupiter's four moons are not solid, like ours, but merely condensed masses of meteorites, like those which compose the belts of Saturn.

New York and Boston now only Five Hours Apart.

For several years past the railway companies have regularly set apart a large share of their earnings in the straightening of their lines, strengthening of bridges, improvement of roadbeds, engines, signals, and other equipments. The good fruits of these efforts are seen in the better accommodations for the public, greater regularity of trains, and increased speed. A recent example is that of the New York, New Haven &. Hartford Railway, which has reduced the time between New York and Boston to the extent of an hour or more. The fast express, over the Shore line, now makes the journey in five hours. One may now take breakfast at home in New York, dine and do business in Boston, and return to the metropolis by early bed time.

Pomade for Dandruff.

Salicylic acid	30 grains.
Powdered borax	15 grains.
Peru balsam	24 minims.
Oil of anise	5 minims.
Oil of bergamot	15 minims.
Vaseline	3 ounces.

The Rule of Contrariety in Inventions.

There is apt to be a fine irreverence about the inventor which leads him to suspect that any old way of doing a thing is for that very reason not the best way. Often he observes some time-honored plan of working, audaciously makes up his mind to do the exact opposite, and hits upon success. Guns were loaded at the muzzle for ages, until one day a man of originality thought of loading them at the other end, the preferable end on many accounts besides that of manifest convenience. The same path was trodden by the Frenchman who first put the eye of a needle near its point instead of away from its point. He little knew that he was doing a great deal to make the sewing machine a possibility. One of the notions of the pioneer railway engineers in England was that their rails must be flanged so that the wheels of locomotives and carriages should not get off the track. But some one of skeptical mind inquired: Why not leave the top of the rail flat, or nearly flat, and put the flange on the wheel, an easier thing to do? Accordingly the flange was taken from the rail to the wheel and remains there to this day, to remind the traveler that an Eastern philosopher said long ago: "To him that is well shod it is as if the whole earth were covered with leather."

It is a good many years now since steam was first used for heating buildings, and as air when warmed ascends, what more natural than that steam coils should hug the floors just as the stoves before them had done? But in some of the largest factories in this country the coils are fastened, not to the floor, but to the ceiling, which proves to be a better place for them. As everybody knows who ever sat before an open fire, radiation is a pleasanter means of warmth than convection, than heat carried along by currents of air; floor space is incidentally saved, and the risk of gathering combustible rubbish about the coils is avoided. In the ages of simplicity which came down to Watt's time and the invention of the steam engine, when a kettle was to be heated the proper place for the fire was thought to be outside. But when big boilers came in, with pressing need that their contents be heated in the shortest time possible, it was found gainful to put the fire inside. Stephenson's locomotive, the Rocket, derived no small part of its efficiency from his knowledge to which side of the boiler to apply flame.

On somewhat the same principle Lord Dundonald, one of the early improvers of the steam engine, forced the hot-air currents under his boiler from above downward, against their natural tendency to move from below upward. In this way he made available much heat that otherwise would have been wasted. The steam engine, whether mounted on wheels or not, always keeps its fuel outside; furnace and cylinder are distinct. To-day the steam engine's primacy is challenged by a motor which uses its fuel inside, the furnace being no other than the cylinder, precisely as in the barrel of a gun. So much more work does a gas engine yield than a steam engine, in comparison with the heat applied, that only the dearness of heat as supplied by gas prevents the speedy sup rsedure of steam for motive power. As gas engines grow steadily larger, their margin of economy becomes so decided that it begins to pay to make gas on purpose to burn in them.

In the reduction of bauxite, the refractory ore of aluminum, it is necessary to maintain an extreme temperature. The melting point of the mineral is high, and only so much of the heat as ranges above that temperature does work. In the Mining Department of the World's Fair is an exhibit showing how the modern metallurgist reduces aluminum with new economy. Instead of employing the old crucible method, and applying the fire from without, he incloses the ore in a non-conducting bed, and by means of a powerful electric current applies the heat from within. Electric furnaces of this type now produce bronze and other alloys at prices which steadily fall as their market enlarges.

Not far from the mining exhibit at Chicago stands Machinery Hall. When its visitors see one of the largest steam engines driving machinery with a slack belt, they are wont to express surprise. Ordinary folks to-day think just what machinists thought a few years ago: that tightness is the effective and, indeed, the only feasible condition for belts. But in this case, as in a good many others, the rule of contraries has come, and with profit.

Architects, as well as engineers and metallurgists, have found it profitable to go into opposition where some ancient practices have been concerned. In latitudes of much fall of rain or snow, the form of roof which most obviously suggests itself is the common pitched roof, resembling an A, more or less broadened. Vexed by bursting rain conductors, by impromptu object lessons as to the force of avalanches, Northern architects take not A, but V, duly widened, for their roof type. In winter, ice and snow, caught as in a basin, cannot fall to the street. Icicles are banished, and in conductors carried through the heart of the building, and kept warm by the building, ice is gradually melted without a chance to do damage.—*N. Y. Sun.*

A Gigantic Irrigation Project.

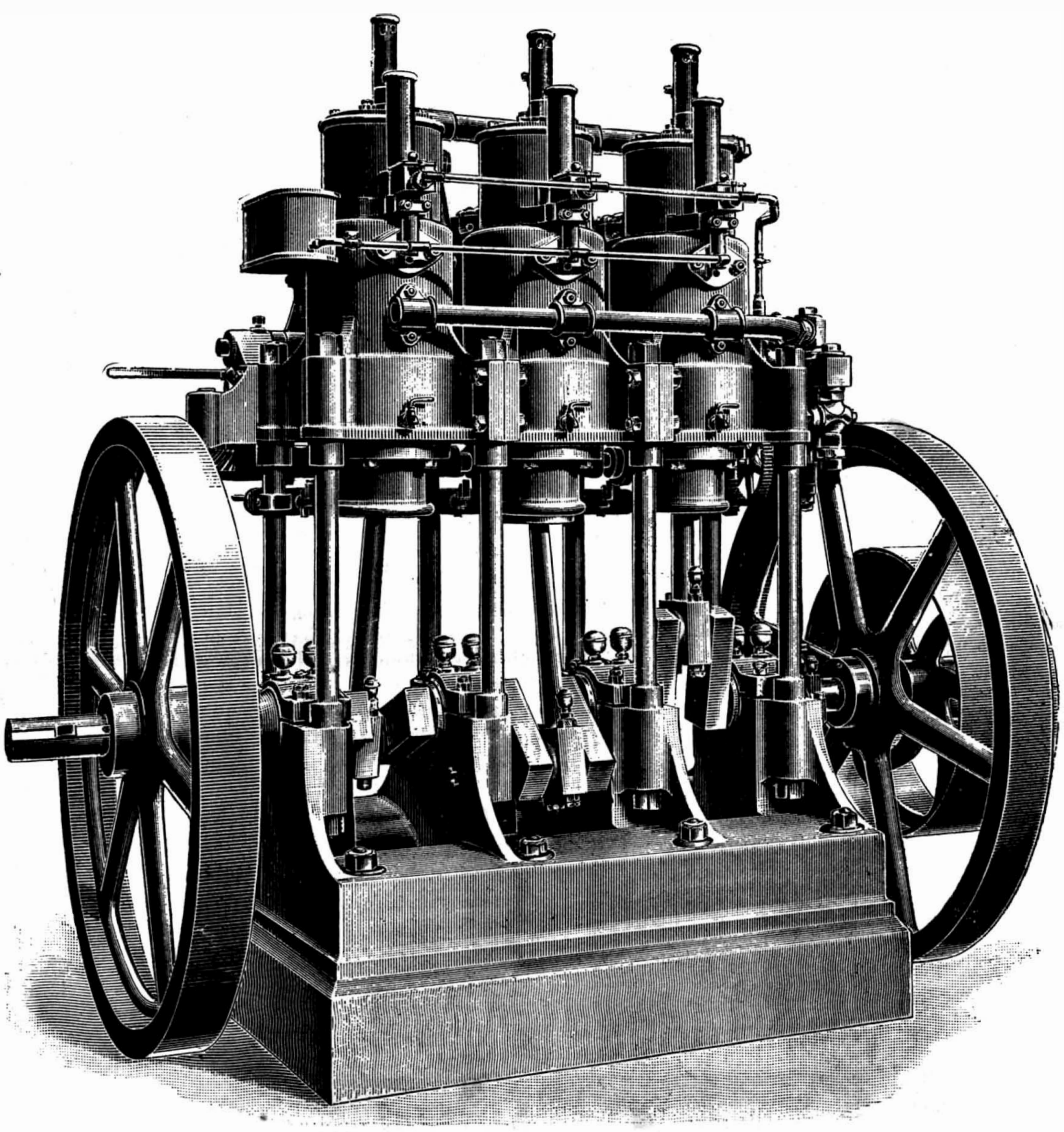
Hardly has the South Gila Canal Company commenced the great work of damming the Gila River and building a canal 125 miles in length, through one of the best portions of Arizona, and before the Sonora Canal Company has completed the survey for its canal in California, when another project of the utmost importance to Yuma and the great area of arable land lying to the south and east of Yuma, in Arizona and the Mexican State of Sonora, is inaugurated. The plan is to dam the Gila River at the gorge, twelve miles east of Yuma, and create a reservoir thirty miles in length and eight miles in width. The dam, which will be of solid masonry, is to be 4,500 feet in length and 110 feet high. It will extend from the mountains on one side of the Gila to the opposite bank on a reef of bed rock, where three small islands rise out of the bed of the stream. These islands will form abutments to the dam, which will be built with such a slope as will carry the water away from the dam without cutting or wearing away the rock at its base. The flume, or canal, which will conduct the water away from this reservoir to the lands to be irrigated, will not be over a mile in length.

From the end of the flume to the south and west, canals will be constructed over the mesa and valley lands in different directions when the lands, which all belong to the United States government, are settled. The reservoir, it is estimated, will hold water enough to irrigate the 3,500,000 acres of land lying to the east and south of Yuma, which extends into the Mexican State of Sonora, and will also furnish water for 100,000 acres of the Sonora Land Company, lying between the dam and Colorado River, in the valley of the Gila. It is estimated that the dam alone will cost $5,000,000, and that it will take two years to complete it.

OIL ENGINES AT THE GREAT EXPOSITION.

The engravings herewith represent an English three-cylinder 20-horse power "Trusty" oil engine, exhibited, the *Engineer* says, in the Chicago Exhibition. The three cylinders are connected to a three-throw crank shaft, with cranks set at 120 deg., so that the work of the three cylinders is well distributed throughout the period of each revolution. The valve gear is worked from one cam shaft, driven by silent worm gearing. The engine is fitted and controlled with one governor of the rotative type, but either of the cylinders may be cut out at will, the valve gear for each being worked by separate cams. With the exception of the changes in form necessary to the vertical construction, the engine is composed of working parts which operate in the same way as those of the horizontal engine which was described in our impression of the 4th December, 1891.

Fig. 1 shows the front of the engine, and Fig. 2 shows the arrangement of the valve gear arms centered upon a fixed shaft and operated by cams, one of each set of which is controlled as to position by the governor, as in the horizontal engine. Fig. 3 shows the end of the engine, and thereby the valve levers and the double pump for supplying air to the ignition tube lamps, and for circulating water round the jackets. The engine is supported on a strong bed-plate of good form, carrying the cylinders on eight turned columns fixed by tight fit in holes on the sides of each bearing, and fastened by nuts which are accessible. The crank is carried in four large bearings and fitted with two fly-wheels. The engine is of good design, and works with ordinary petroleum lamp oils or with the heavier Broxbourne oil. It is made by Messrs. Weyman & Hitchcock, Limited, Guildford, and is exhibited in the Chicago Exhibition by Messrs. Baker & Co.



THE WORLD'S COLUMBIAN EXPOSITION—TWENTY HORSE POWER OIL ENGINE.
Fig. 1.—FRONT VIEW.

Enormous Enterprises.

The advancing years seem to produce an increase rather than a diminution in the number of gigantic schemes. We have all heard of the scheme for expending $40,000,000 in the construction of a monster dam in the vicinity of Newfoundland that would turn the Gulf Stream back on itself and give New England a tropical climate, so that the Granite State boys could climb palm trees to shake off the succulent cocoanut on their own bleak hillsides, while the Rhode Islanders would offer scant encouragement to the peripatetic Italian banana vender, as each and all of them would have a banana tree in close proximity to his own back porch.

A more recent scheme is the bridging of the English Channel between Dover and Calais. It is said that this scheme has gone so far that a company has been formed to secure the necessary concessions from the British and French governments. The cost of this bridge is something like $240,000,000.

The latest scheme is one for roofing London and other large cities, and thus doing away with the umbrella trust. The projector has not yet considered any such vulgar and insignificant detail as the matter of cost, and hence has not enlightened the public on this point.

Such schemes are, adds the *American Artisan*, of course, largely visionary; but they indicate a tendency to grapple with the most stupendous undertakings that is in a manner characteristic of the nervous and progressive age in which we live.

A FRENCHMAN declares that vegetation can be aided by electricity. Potatoes planted in the path of the electric current grew enormously, and electrified tomatoes became ripe eight days before the others.

Unsolved Problems that Edison is Studying.*

Thomas A. Edison, when he was congratulated upon his forty-sixth birthday, declared that he did not measure his life by years, but by achievements or by campaigns; and he then confessed that he had planned ahead many campaigns, and that he looks forward to no period of rest, believing that for him, at least, the happiest life is a life of work. In speaking of his campaigns, Mr. Edison said:

"I do not regard myself as a pure scientist, as so many persons have insisted that I am. I do not search for the laws of nature, and have made no great discoveries of such laws. I do not study science as Newton and Kepler and Faraday and Henry studied it, simply for the purpose of learning truth. I am only a professional inventor. My studies and experiments have been conducted entirely with the object of inventing that which will have commercial utility. I suppose I might be called a scientific inventor, as distinguished from a mechanical inventor, although really there is no distinction."

When Mr. Edison was asked about his campaigns and those achievements by which he measured his life, he said that in the past there had been first the stock-ticker and the telephone, upon the latter of which he worked very hard. But he regarded the greatest of his achievements, in the early part of his career, as the invention of the phonograph. "That," said he, "was an invention pure and simple. No suggestion of it, so far as I know, had ever been made; and it was a discovery made by accident, while experimenting upon another invention, that led to the development of the phonograph.

"My second campaign was that which resulted in the invention of the incandescent lamp. Of course an incandescent lamp had been suggested before. There had been abortive attempts to make them, even before I knew anything about telegraphing. The work which I did was to make an incandescent lamp which was commercially valuable, and the courts have recently sustained my claim to priority of invention of this lamp. I worked about three years upon that. Some of the experiments were very delicate and very difficult. Some of them needed help which was very costly. That so far has been, I suppose, my chief achievement. It certainly was the first one which made me independent, and left me free to begin other campaigns without the necessity of calling for outside capital, or of finding my invention subjected to the mysteries of Wall Street manipulation."

The hint contained in Mr. Edison's reference to Wall Street, and the mysteries of financiering which prevail there, led naturally enough to a question as to Mr. Edison's future purpose with regard to capitalists, and he said:

"In my future campaigns I expect myself to control absolutely such inventions as I make. I am now fortunate enough to have capital of my own, and that I shall use in these campaigns. The most important of the campaigns I have in mind is one in which I have now been engaged for several years. I have long been satisfied that it was possible to invent an ore concentrator which would vastly simplify the prevailing methods of extracting iron from earth and rock, and which would do it so much cheaper than those processes as to command the market. Of course I refer to magnetic iron ore. Some of the New Jersey mountains contain practically inexhaustible stores of this magnetic ore, but it has been expensive to mine. I was able to secure mining options upon nearly all these properties, and then I began the campaign of developing an ore concentrator which would make these deposits profitably available. This iron is unlike any other iron ore. It takes four tons of the ore to produce one ton of pure iron, and yet I saw, some years ago, that if some method of extracting this ore could be devised, and the mines controlled, an enormously profitable business would be developed, and yet a cheaper iron ore—cheaper in its first cost—would be put upon the market. I worked very hard upon this problem, and in one sense successfully, for I have been able, by my methods, to extract this magnetic ore at comparatively small cost, and deliver from my mills pure iron bricklets. Yet I have not been satisfied with the methods; and some months ago I decided to abandon the old methods, and to undertake to do this work by an entirely new system. I had some ten important details to master before I could get a perfect machine, and I have already mastered eight of them. Only two remain to be solved; and when this work is complete, I shall have, I think, a plant and mining privileges which will outrank the incandescent lamp as a commercial venture, certainly so far as I am myself concerned. Whatever the profits are, I shall myself control them, as I have taken no capitalist in with me in this scheme."

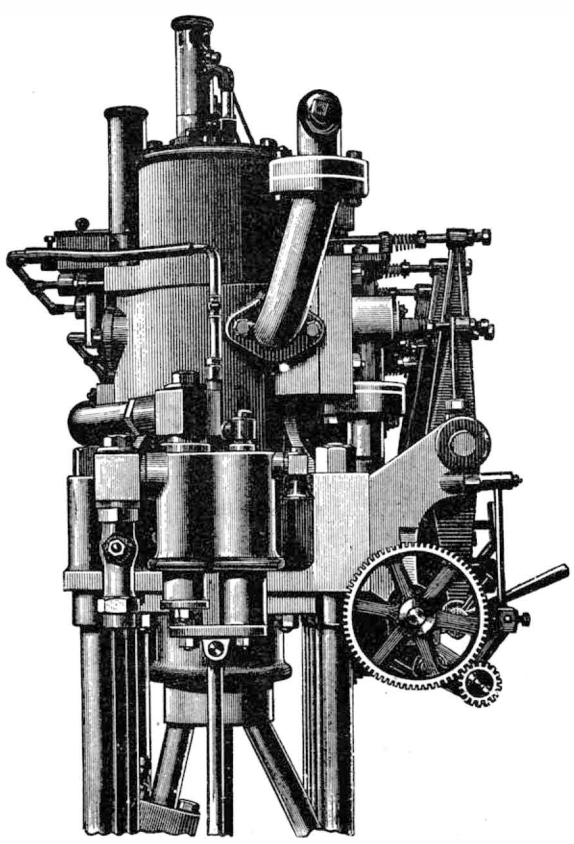


Fig. 3.—END VIEW.

Mr. Edison was asked if he was willing to be more explicit respecting this invention, but he declined to be, further than to say: "When the machinery is done as I expect to develop it, it will be capable of handling twenty thousand tons of ore a day with two shifts of men, five in a shift. That is to say, ten workmen, working twenty hours a day in the aggregate, will be able to take this ore, crush it, reduce the iron to cement-like proportions, extract it from the rock and earth, and make it into bricklets of pure iron, and do it so cheaply that it will command the market for magnetic iron."

Mr. Edison, in speaking of this campaign, referred to it as though it was practically finished; and it was evident in the conversation that already his mind turns to a new campaign, which he will take up as soon as his iron-ore concentrator is complete and its work can be left to competent subordinates.

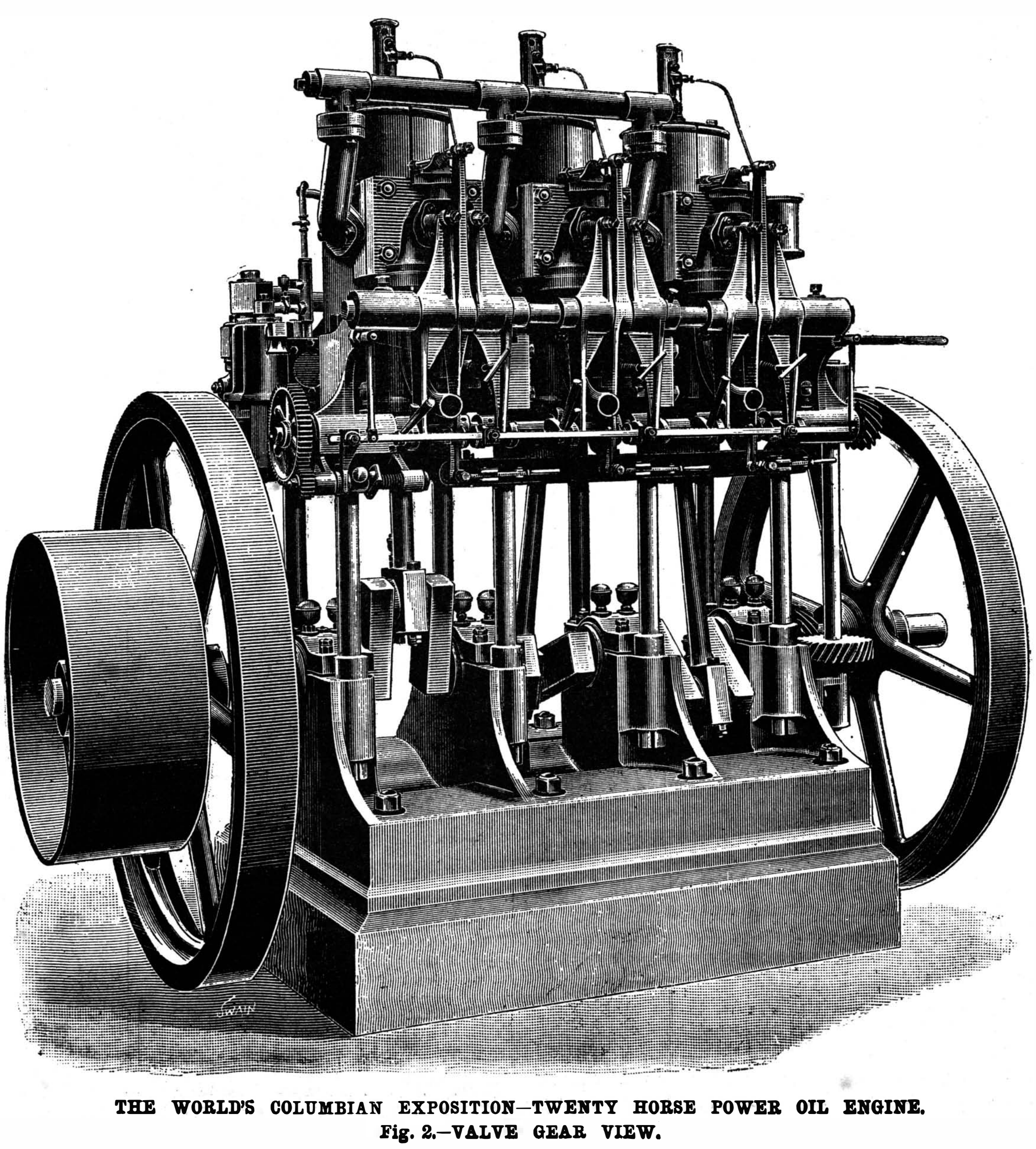
He was asked if he would be willing to say what he had in his mind for the next campaign, and he replied: "Well, I think as soon as the ore-concentrating business is developed and can take care of itself, I shall turn my attention to one of the greatest problems that I have ever thought of solving, and that is, the direct control of the energy which is stored up in coal, so that it may be employed without waste and at a very small margin of cost. Ninety per cent of the energy that exists in coal is now lost in converting it into power. It goes off in heat through the chimneys of boiler rooms. You perceive it when you step into a room where there is a furnace and boiler. It is also greatly wasted in the development of the latent heat which is created by the change from water to steam. Now that is an awful waste, and even a child can see that if this wastage can be saved, it will result in vastly cheapening the cost of everything which is manufactured by electric or steam power. In fact, it will vastly cheapen the cost of all the necessaries and luxuries of life, and I suppose the results would be of mightier influence upon civilization than the development of the steam engine and electricity have been. It will, in fact, do away with steam engines and boilers, and make the use of steam power as much of a tradition as the stage coach now is.

"It would enable an ocean steamship of twenty thousand horse power to cross the ocean faster than any of the crack vessels now do, and require the burning of only two hundred and fifty tons of coal instead of three thousand, which are now required, so that, of course, the charges for freight and passenger fares would be greatly reduced. It would enormously lessen the cost of manufacturing and of traffic. It would develop the electric current directly from coal, so that the cost of steam engines and boilers would be eliminated. I have thought of this problem very much, and I have already my theory of the experiments, or some of them, which may be necessary to develop this direct use of all the power that is stored in coal. I can only say now, that the coal would be put into a receptacle, the agencies then applied which would develop its energy and save it all, and through this energy electric power of any degree desired could be furnished. Yes, it can be done; I am sure of that. Some of the details I have already mastered, I think; at least, I am sure that I know the way to go to work to master them. I believe that I shall make this my next campaign. It may be years before it is finished, and it may not be a very long time."

Mr. Edison looks farther ahead than this campaign, for he said: "I think it quite likely that I may try to develop a plan for marine signaling. I have the idea already pretty well formulated in my mind. I should use the well known principle that water is a more perfect medium for carrying vibrations than air, and should develop instruments which may be carried upon sea-going vessels, by which they can transmit or receive, through an international code of signals, reports within a radius of say ten miles.

Mr. Edison believes that Chicago is to become the London of America early in the next century, while New York will be its Liverpool, and he is of opinion that very likely a ship canal may connect Chicago with tide water, so that it will itself become a great seaport.

*By E. J. Edwards, in *McClure's Magazine*, June, 1893.



THE WORLD'S COLUMBIAN EXPOSITION—TWENTY HORSE POWER OIL ENGINE.
Fig. 2.—VALVE GEAR VIEW.

PARIS has 87,655 trees in its streets, and each tree represents a cost to the city of £7. This makes, in round numbers, £600,000 worth of trees in the streets.

Exposition Notes.

(*Continued from page 19.*)

can be seen scattered about the grounds and buildings resting and eating lunch. In order to accommodate lunch parties, the Exposition has provided every convenience for their comfort in the building under the charge of the Bureau of Public Comfort. In addition to the foregoing expenses, there is the cost of an occasional trip on the Intramural road, and there should be a few rides on the electric launches and also on the steam launches out into the lake, so as to secure a good view of the Exposition grounds from the water front. The expense of these trips should not exceed $2. Then there are concessions of various sorts, some of which each visitor will want to indulge in according to his taste, the size of his purse and the amount of time at his disposal. But the entire cost of these to the visitor of a week should not exceed $5. All these estimates are based on actual experience, and to a person who is at all judicious they should be outside figures, so that the expense in itself for the seven days would cost $14. Going back and forth from the boarding place to the Exposition would not cost over $2 at the most for the ordinary means of transportation. The round trip by boat is 25 cts., and this is a trip that should be taken because of the opportunity it affords of seeing the beauty of the Exposition grounds from the lake. The Illinois Central Railroad has a most excellent and efficient service, for which it charges only 10 cts. a trip, while the cable and elevated roads carry passengers to the grounds for a 5 ct. fare.

If one will come into the grounds from the lake through that marvelous entrance which seems to revive to a college graduate what he imagined the entrance to some of the ancient cities might have been, and sail into the lagoon on a gondola, he will get some impression of the vastness, the architectural beauty, and completeness of this preparation, which it is impossible to describe. Superlatives are unequal to the occasion. Then you must add to that the thirty buildings of the various States of the Union, which, in size and appointment, surpass the buildings of the different nations at the Paris Exposition. The illumination itself was worth a visit from New York.

This Exposition will be of value to every visitor, according to the degree of intellectual or other cultivation he brings with him, to avail himself of the infinite number and variety of the objects presented to his gaze. The whole time that the display will be open, it will soon be discovered, cannot but be altogether insufficient to make anything like a minute inspection of the departments. Take, for example, the Art Palace. In that gorgeous structure there are not less than 8,073 exhibits, one-half of which consist of pictures in oil and the other half of statuary, water colors, pastels, engravings, etchings, and pen and ink, charcoal, black and white, and other drawings—all of exceptional value. Surely one minute cannot be thought too long a time to devote to the study of each example. Yet such a brief time would amount to one hundred and thirty-five hours, or twenty-two and one-half days of six hours each.

The Japanese building, Hooden, as it is called, has been carefully reproduced at the Fair. It represents the architecture of three different epochs. The central portion belongs to the seventeenth century, the south wing to the fifteenth century, and the north wing to the eleventh century. The main structure has a double roof, sloping in graceful curves on four sides from a gabled over-roof. Two striking features of the exterior decoration are weathercocks representing the bird hoo. They are cast in a metal called kodo, an alloy of gold and copper. In the principal portion are three large images of Buddha, carved in wood by the famous sculptor Jo Cho. Rich traceries of wondrous color adorn the ceiling, and their effect is intensified by the skillful introduction of precious stones. Walls and doors are overlaid with gold leaf. Panels containing either scenes from the paradise of Buddha or texts from the sacred books are disposed alternately as a decorative scheme. Western art may imitate but hardly equal this decorative work. The original edifice—the seat of the great house of Tokugawa for nearly three hundred years—has had a most remarkable history. Although many destructive wars have occurred since its erection, yet the exquisite decorations remain substantially intact.

A few days ago there was excitement near "Blarney Castle." A box had arrived there, and soon there came a custom house officer with an invoice which called for "one Blarney stone." When the box was opened it was found to contain a fragment, weighing forty pounds, of the celebrated Blarney stone itself. That portion had been severed for many years, and was now loaned by the Irish authorities to Lady Aberdeen. It must be returned when the Fair is over. According to the legend, Cormack Macarthy held the castle of Blarney in 1602, and concluded an armistice with Carew, the lord president, on condition of surrendering the fort to the English garrison. Day after day his lordship looked for the fulfillment of the terms, but received nothing but protocols and soft speeches, till he became the laughing-stock of Elizabeth's ministers and the dupe of the lord of Blarney. Another legend has it that the stone is really a fairy, whose lover had been slain in battle. Before having changed herself into stone, she obtained from the spiritual powers the wish that whoever kissed the stone might receive the ability to become a great talker. The fragment has been placed in position on the model Blarney Castle, but not quite in such a dangerous situation as in the original.

Among the many articles of rare and curious make is a very delicate handkerchief among Queen Margherita's laces. It is valued at $30,000. Three different artists have wrought upon it during a period of not less than twenty years. It is so light that one is not conscious of it touching the hand if the eyes be shut, and it can be easily folded into a gold casket not larger than a Boston bean.

It is said that a Scotsman who employs 4,000 French women near Paris making lace has sent a pair of curtains for a bay window. In the six months required for the making of these curtains two thousand different women worked on them. They are only three yards long; but the cost was $6,000. This Scotsman has a $50,000 exhibit of laces, and he came himself to superintend their effective hanging.

Among the mineral curiosities there is a twelve ton lump of cannel coal sent from Lancashire, England, by the Wigan Junction Colliery. Pennsylvania has put up a pyramid of anthracite, ten feet square at the base and fifty-two feet high. It contains just one hundred tons. From George's Creek, Allegheny County, Md., comes a lump of cannel coal 15 feet long, 4 feet wide, and 3 feet thick. The Roslyn lump from the State of Washington is the largest ever mined. It is 5 feet thick, 26 feet long, and weighs more than 50,000 pounds.

Mr. Gladstone has sent one of his axes for exhibition in the Forestry building. It is of fine steel, and is very sharp and heavy. As is very evident from the worn condition of the ash handle, the tool had done considerable service. So far as is known, this is the only instance of an ax having been permitted to pass out of the possession of the veteran British premier, and the principal members of the timber trade of the country appreciate highly the exceptional honor thus displayed to them and their craft.

A CORNER OF THE PALACE OF MINES AND MINING.

At the left of the western entrance to this building is the Japanese exhibit—Japan's demonstration to the world that western scientific methods have been adopted. Specimens of her riches are shown—gneiss, sandstone, clay, lava, granite, all beautifully arranged in series of graduated test tubes to show a mechanical analysis. At one end of the series the "mother rock" in a mass, at the other a tube containing the soil, the intervening tubes, from six to twelve or so in number, showing the degrees of disintegration. This is the work of the Imperial Geological Survey. So are the remarkably beautiful colored geological maps on the walls. They show the strata, mineral deposits, etc., of the islands. The attendant told me that they were executed at the Tokio University. Beside them hang series of photographs of the mining processes. They, too, are clear and most carefully made. Ingots of copper and antimony are displayed. The specimens of stibnite are not finer than those in the Natural History Museum in New York, but they are so numerous that one realizes that the magnificent crystals are not rare in Japan. Iron ores are represented, chiefly by hematite, marcasite, and pyrite. Anthracite and cannel coal are shown in small masses. Graphite crucibles range from one of the capacity of a pint to those of very large size, of fully twice the capacity of those used at the Brooklyn Chrome Steel Works in the manufacture of steel. Table salt is displayed in bags and glass jars. In the latter some of it is in ornamented disks, as if run in a mould.

Beautiful specimens of native sulphur are in the cases, and on the floor are two masses of "roll brimstone," not less than four feet in length. Among the minerals shown the specimens of rhodonite, beryl, and amethyst are notable. One case is filled with white topazes. The display, so far as I have spoken of it, might have been arranged anywhere in our own country. The object which is characteristic and national is a miniature mountain. Near the summit is a tiny temple, steps cut to it from the foot, and little flags placed at intervals on the way up.

This is all the casual visitor sees, but to one who has made the acquaintance of the gentlemanly Japanese in attendance, the mountain is opened. Within are four galleries showing every step of the process of mining copper. It is alive with Liliputian figures in every possible position. The ore is lowered in buckets, arranged on pulleys run by windlasses. The smelting pots are in the lowest gallery, and a tiny figure holds a book the size of my little finger nail, in which he makes his record of the assay. It is but a step from the Japanese exhibit into that of the Canadian provinces. It is evident they have felt that this is a valuable opportunity to show their neighbors their mineral resources. British Columbia announces in a conspicuous place: "Total yield of gold from placer fields from 1858 to 1893, $53,512,652. The quartz veins from which this has been derived have not yet been worked. They offer fine field for investigation."

The quartz is here in large masses, yellow enough to be suggestive. An immense pyramid of blocks in imitation of gold bullion is close at hand. "Am I to understand that this is real gold?" said an earnest-faced woman to the attendant.

"No, madam, we could not afford to have so much gold out of use," was the reply of the man with inflexible features.

"I told her I was sure it couldn't be, but she knew it was; so I just thought I'd ask."

Very likely the attendant has been asked the same question so often that it has ceased to be amusing to him.

Asbestos in large quantities is shown from both Quebec and Ontario.

The Johns Asbestos Manufacturing Company has some of its machinery only a few feet away, where one can see the crude material changed into cloth and also see the various grades of paper made of it. The company has had great demand for this for use in the Fair buildings, and in the temporary lodging houses, where it forms walls and ceiling.

Ontario shows a fine display of mica sheets easily two and a half feet in diameter. Sperrylite is a newly discovered arsenide of platinum. It is a yellow dust-like powder found in pockets and assays fifteen ounces to a ton of platinum. Small quantities of gold, osmium and iridium are also found in it. The name of the ore is derived from its discoverer, a Mr. Sperry. Near by is a quantity of black, slaty ore which also contains a small per cent of platinum, supposed to be in paying quantities, but not yet developed.

Nickel derived from pyrrhotite and chalcopyrite is shown in every stage of its reduction from the ore, and large photographs of the processes are to be seen.

Apatite is shown in every state—magnificent crystals, too fine for any place but a cabinet, and the amorphous masses fit to be ground for a fertilizer. Quantities of steatite and graphite are here, and very rich serpentine. The beautiful serpentine vase was made at the Canadian Granite Works, at Ottawa.

The New Rockland Slate Company, of Montreal, would have us believe that no well appointed city house can afford to be without their slate wash tubs, made so that the front of the tub forms the wash board.

Nova Scotia shows a variety of building stones, quantities of red and brown hematite, and a tempting display of gold-bearing quartz.

New Brunswick has sent red granite, in column and monument. Gypsum forms a part of the exhibit from this province in its native condition and reduced to plaster of Paris.

Next to the Canadian section is the Australian. In this, one feels that gold is not only widely distributed, but must be very abundant. It is shown in nuggets, strings, grains, octahedra, and embedded in the quartz. But most interesting are the specimens of good sized, irregular masses, separated from the quartz by the action of hydrofluoric acid. Why does this not suggest the opening of a great industry in Greenland in cryolite? Australia shows immense circular piles of ingots of copper and tin, the latter trimmed with ribbons and rosettes of tin.

In the South African section blue asbestos is to be seen, about the color of lazulite. The principal attractions in this exhibit are, first, the machinery (which is in operation from two to four in the afternoon) for crushing the diamond-bearing rock, washing the fine particles, and separating the gems; and second, the sturdy Africans who operate it. They look as if they had just come from a kraal. Nowhere have I seen the crowd so dense and eager as about this exhibit.

An Ericsson Medal.

A medal commemorating the life and services of the late Capt. John Ericsson has been presented by the Swedish government to Col. W. C. Church, editor and proprietor of *The Army and Navy Journal*, New York, with whom was left Ericsson's private and business papers, and who has written a biography of the great inventor. The medal is of silver, and beautifully executed, there being on the obverse a medallion head of Ericsson and on the reverse a monitor under steam, with Latin inscriptions describing Ericsson as "skilled in the mechanic arts and wise in war."

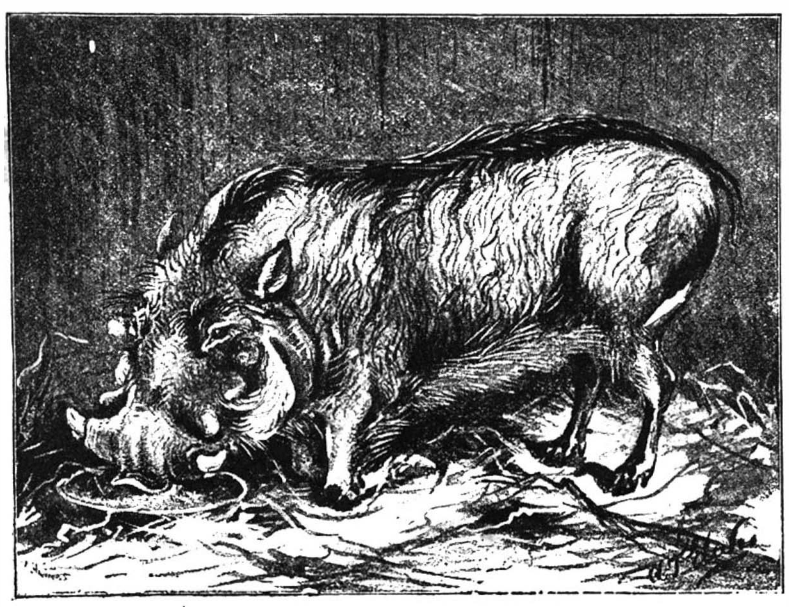
INVENTION is sometimes thought to have reached its limit, but of the energy in a pound of coal when burned, some one has calculated that only 1 per cent is used in moving a passenger and only one-half of 1 per cent in incandescent electric lighting. The rest goes in friction and waste. The problem of the next century is going to be the saving of this wasted 99 or 99½ per cent, just as the problem of the last century has been to secure the use of 1 per cent which moves trains and the ½ per cent which makes an electric light.

Metal Ties in Mexico.

According to Engineer John Birkinbine, the Mexican Railroad has now some 150 miles of track, including the Pachuca branch, laid with steel ties which weigh 124 pounds each, or 126 pounds with the two key bolts. These ties are 8 feet 3 inches long, rolled so as to have a longitudinal web, and have clips for holding the rails formed by cutting slots out near either end of the sleeper and bending up the steel. The first metal ties of crude design were placed on this road fourteen years ago. On the Inter-Oceanic Railroad, some 50 miles had been laid with "pot" sleepers, an English monstrosity, consisting of two cast iron dishes oval in form, which were inverted in the ballast and connected together by wrought iron bars, the rails being keyed to the pots. About one-fourth of these have been replaced by steel sleepers, and further replacement is made as rapidly as finances permit. The steel sleepers now used are 6 feet long, weigh 90 pounds each, and have near the ends square bolt holes, but no clips. These nest nicely for shipping, and cost $1 gold per sleeper, delivered at Vera Cruz. Wooden ties, 8 feet × 6 inches × 6 inches, cost in the vicinity of Pueblo and Mexico 63 cents for pine and 95 cents for oak; therefore, at the present exchange, the pine ties cost in gold 42 cents and the oak ties 64 cents each. As railroad supplies pay no duty, the expense for steel ties is, therefore, not greatly in excess of wood. On the Southern Railroad (3 foot gauge), steel ties 8 feet long, weighing 110 pounds, are used.

THE WART HOG, OR VLACKE VARK.

This is a new arrival at the Zoological Gardens. The wart hog, or vlacke vark, or Ethiopian wart hog (*P. Æthiopicus*), is a native of Southern Africa. This species differs from his brother from North Africa (Ætians wart hog), inasmuch that his warts at the side of his face are larger; in fact, he is a more formidable animal, his tusks, when full-grown, reaching eight inches in length. The animal lives entirely on roots. The color of this hog is gray, with dark mane, and hair sparsely scattered over the body. When chased, Gordon Cumming says, he presents a most ludicrous appearance on account of his short neck, being unable to look round, and naturally anxious to see if his pursuers are gaining upon him, he is obliged to lift his snout well in the air, so as to look over his shoulder, and with that, and his tail, when running, stiff and upright, he has a most absurd look. The above sportsman also says the animal is not devoid of sagacity.—*Black and White.*



THE WART HOG.

Do Doctors Spread Contagion?

The surgeon and the obstetrician utilize the means that experiment and observation have proved necessary to render their work aseptic. In case of the entrance of disease germs, they take prompt means to destroy them, or to neutralize their effects. It behooves us, who practice among children suffering from contagious diseases, to inquire if we are equally careful.

The surgeon about to open an abdominal cavity removes all possible sources of infection from his patient's person and environment, and goes to his work with clean linen and clean hands. Do we do likewise?

Some time ago a prominent operator sent me an invitation to witness an abdominal section, adding in his note, "Provided you have not visited a case of scarlet fever or other contagious disease during the last twenty-four hours." I could not but think, if such precaution is necessary to insure the safety of this patient, what are the risks to the little children that I shall visit after seeing the case of scarlet fever or other contagious disease, and whose systems are fertile soils for the poison to develop it?

The danger of such conveyance is great, as physicians with large family practice know, and many, like myself, have been taught the lesson by sad experience. I can recall several instances in which the children of physicians have fallen victims to scarlet fever and diphtheria, the cause being clearly traced to disease brought home by their fathers.

Let me illustrate this danger by a description of a physician's visit to a case of diphtheria. The doctor enters the house, removes his hat, overcoat and gloves, and is shown into the room containing the patient, and comes into direct contact with the atmosphere loaded with the germs of the disease. His hair, woolen clothing, hands, etc., must more or less absorb the poison, in his stay of about fifteen minutes. What does he then do? He replaces his overcoat, carefully buttoning it up, as if to keep as many of the germs as possible warm and well protected. He puts on his hat as he crosses the threshold, jumps into his carriage, covers himself with robes, and drives to his next patient; enters, takes off his hat and coat, and wo to any little ones who live in that house! The doctor has probably that with him which will more likely kill than cure.

What should be done to diminish this danger? Stay no longer in a house containing a contagious disease than is absolutely necessary. Don't remove your hat or unbutton your coat in that house. After examining the patient go down stairs, preferably at an open door or window, and give directions for treatment. The family of the patient will respect you for the care you exercise when you explain the reason. Drive without covering with robes to your next patient, and be sure that patient is not a child. Never allow a messenger from a case of contagious disease to call or wait for you in your office. Instruct him to bring written messages and leave them at your door. If the messenger wishes to speak to you, tell him to wait outside your office and ask the servant to call you to the door.

I have more than once been startled on entering my office to see a man or woman whom I knew had been constantly for days and nights nursing a bad case of diphtheria, sitting complacently alongside of two or three children, all waiting to see me. On several occasions mothers have brought children, suffering from severe attacks of diphtheria, to my office and waited to see me.

When you come home from a case of contagious disease, besides washing your hands, face and head with soap and water, hang up your hat and coat in the air, and put on a fresh coat.

I did this some time ago and forgot to bring them in when I went to bed. It rained hard all night—but better lose a hat and coat than a patient.

If you return late at night from a case of contagious disease, besides washing, undress before going into the room where your children are. Keep your own children out of your office, and do not take them in the carriage with you when visiting patients. How do you know but some of your calls may be upon those with contagious diseases?

Our board of health instructs us, in cases of contagious diseases, to forbid the children of the household to attend school or other places of public resort. This is a wise precaution, and the doctor, when he has been in contact with contagious disease, should, so far as possible, follow the advice given to the children.

We are told that familiarity with crime leads us to endure it. Likewise familiarity with contagious disease is likely to make us at times careless in using the means necessary to prevent its spread. Physicians are but mortals, and while as a body they are conscientious in the discharge of their duties, candor compels me to confess that they are not at all times as careful as they should be.—*Dr. John Graham, in Phila. Medical News.*

The Purification of Water.

The drought happily appears to be coming to an end, but the welcome showers of rain must be continued for some time if our stock of water is to be adequately replenished. In the meantime, the water supplied for domestic use must necessarily have become less and less pure and the impurities which pollute the streams less attenuated. The increased proportion of suspended and dissolved impurities which are presented to the sand filters must greatly impede the filtering process, and if this process is hastened—and we cannot doubt but that the temptation must occur to do this—inadequate treatment results and water unfit for drinking purposes may be distributed in the mains. A continued season of dry weather is especially a time at which very careful regard to the treatment of water for drinking purposes should be given.

The purification of water supplied to the consumer's house, be it from the pump or the main, may be effected thoroughly and efficiently if he will only exercise ordinary care and judgment in regard to the use of filters or to other treatment of the water. Water may be made fit for drinking by three processes: 1, treatment by precipitation; 2, by filtration; and 3, by boiling. In some cases it is advisable to combine the effects of two or more courses of treatment. The latter process (boiling), though of course efficient, is not popular, because the water is rendered tasteless and insipid by withdrawal of the gases, chiefly oxygen and nitrogen, and part of the mineral salts in solution. Treatment by filtration is largely in vogue because it it simple and convenient. It is well known, and it is to be feared that it occurs in many instances, that filtration may render the water much less pure. A word therefore with regard to the choice and management of filters. The best and most effective filtering materials are those which not only remove organisms, matters in suspension, or even soluble matters, but which exert an oxidizing action upon the organic contents of the water and an aerating action upon the water itself. Such agents are well burnt animal charcoal, spongy iron, magnetic iron, polarite and coke. For the mere removal of organisms, filtration through kieselguhr and biscuit porcelain is effectual.

Animal charcoal has grown into disrepute owing to the observation that the organic constituents of water in long contact with it decompose more rapidly than they otherwise would do, a fact which is probably accounted for by the presence in the charcoal of calcium phosphate, a material which favors the growth and development of low forms of life. If properly cleansed and frequently renewed, however, animal charcoal exerts a marked purifying as well as aerating effect upon impure water. Whatever medium is used, every part of the filter should be easily got at for the purpose of cleansing or for the renewal of the filtering material.

We have repeatedly drawn attention to the investigations of Dr. Percy Frankland upon the action of filtering agents, whose experiments showed that well carbonized coke was one of the best filtering materials that could be used. It is cheap, can be easily renewed, and effects the removal of organisms better than any other material experimented with. A drawback to its use is the long preliminary washing it requires before the water becomes clear, owing to the presence in its multiple pores of tarry matters derived in the distillation of the coal. When foul it is still available of course for use as fuel. A common barrel of eighteen gallons capacity provided with a false bottom and filled with layers of respectively fine, medium, and coarse pieces of coke, the latter at the top, has, in our own experience, answered admirably.

Purification by means of precipitating agents has recently been the subject of considerable investigation, and the purifying effects of this treatment, both as regards the removal of organisms and of suspended or dissolved matter, are surprising. Purification by this means is best accomplished by the use of alum. This substance (two or more grains to the gallon will suffice) is decomposed with the formation of a flocculent precipitate (hydrate of alumina, Al_2O_3), which rapidly settles and carries down all suspended matter as well as a large proportion of dissolved organic matter. The precipitation is further attended with a very large if not complete reduction in the number of micro-organisms present. In response to inquiries that have reached us from numerous correspondents, we strongly recommend this treatment in lieu of boiling, preliminary to passing the water through a filtering medium of well known purifying powers, such as those we have enumerated. One of the best is, as we have already said, coke. The addition of alum does not interfere with the normal taste of the water, is itself eliminated as alumina in the sediment, removes some of the lime, and, above all, does not de-aerate the water as in the boiling process. By first precipitating, therefore, in the way suggested, and then filtering security is made doubly secure, and the water so treated, which should not be insipid, may be consumed with confidence.

It may be added that tartaric acid or citric acid has been found to be destructive to disease-producing organisms, notably the bacilli of cholera, and an ingenious filter has been constructed in which tartaric acid is first dissolved in the water and then neutralized and removed as calcium tartrate by means of chalk. At the same time the chalk yields carbonic acid to the water, which is thereby agreeably aerated.—*Lancet.*

ONE of the rooms of the Press Bureau, at the Chicago Exposition, has its walls entirely papered with title pages of leading publications from all over the world. These publications include daily papers, religious and trade papers, magazines, etc. A central feature on this wall is the title page of the SCIENTIFIC AMERICAN. Every nation and nearly every colony in every part of the world is represented. The effect of this method of papering is remarkably good.

RECENTLY PATENTED INVENTIONS.

Electrical.

AUTOMATIC WEIGHING SCALE. — Charles F. Wood, Richmond, Va. Combined with a hopper having a door and a scale beam is an electro-magnet with circuit arranged to lift the door by the contact of the scale beam, the magnet being movable to follow the beam and lift the door by mechanical as well as electrical action, there being also a movable receptacle and a bag holder, with transfer funnel, supporting lever and operating magnet, to transfer the contents of the weighing receptacle to the bag. The improvement is especially designed to facilitate putting up in packages a small quantity of seed or other loose merchandise, doing the work quickly and accurately, and giving to each package a uniform weight.

ROAD VEHICLE.—John W. Moakler, Denver, Col. This is a vehicle adapted to be propelled by storage battery or other generator of electricity, a series of storage batteries being connected to a regulator and switch below the vehicle seat, by which the current may be properly directed to the motor. The improvement consists mainly in the application of a worm screw fastened directly on the shaft of the armature or motor, which saves power and simplifies the construction.

LIGHTING SYSTEM.—Charles L. Morey, Centralia, Ill. In the door casing, according to this invention, is arranged a casing containing an electric lamp, a push button sliding in the casing being adapted to close the circuit and light the lamp. The improvement constitutes a simple form of door attachment designed to afford sufficient light to enable one to select the proper key, at the same time illuminating the door lock to facilitate finding the keyhole.

Railway Appliances.

CAR COUPLING.—James H. Swindell, Reidsville, Ga. This coupling comprises a novel form of latch and cover plate fitted on the drawhead with pin openings for the coupling pin and a connected guide arm coinciding with those of the drawhead, and the latch is connected with a spring. The longitudinal movement of the drawheads in bumping together is designed to operate the devices supporting the pin and the link holder, the released pin then falling to complete the coupling. The device will readily couple cars of different heights, the coupling in all cases being automatically effected.

Agricultural.

SULKY PLOW.—Joseph Willmann, New Braunfels, Texas. According to this invention a plow block is clipped to and fitted to slide upon the axle, the plow beam being secured to the block, while a lever pivoted for movement transversely of the sulky has link connections with the plow block. The mechanism is capable of attachment to any form of wheeled plow, and by its means the plow may be shifted laterally by the driver during the act of plowing to change the cut or avoid obstructions, etc.

Miscellaneous.

BALLOT REGISTERING DEVICE.—Urban G. Iles, Wellston, Mo. This improvement is designed for use in connection with a ticket conforming with the Australian ballot, the size of the ticket being such that it fits snugly in a pocket or recess of the voting machine, where it is placed after the voter has punched holes opposite the names of the candidates for which he does not desire to vote. The machine has registering wheels and pins arranged for mutilating the ticket in such a way that it may be mechanically counted, accurately registering the votes and exhibiting the number of ballots cast, so that the vote may be ascertained at any time.

UMBRELLA AND CANE HOLDER.—Heinrich Egberts, Bremen, Germany. This improvement comprises three connected and co-operating parts—a plate having recesses to receive the umbrella handles, canes, etc., cruciform rotatable devices pivoted adjacent to the recesses and projecting into them as they rotate, and spring pawls or detents that engage the arms of the devices. To hold the umbrella or other article, the lower end is placed in the trough at the bottom and the upper end pushed into one of the recesses, thus swinging one arm of a cruciform piece out of the way, and causing another one to swing into its place to properly secure the umbrella.

PHOTOGRAPH HOLDER.—Dion T. Elmer, Monroe, Mich. A flat slotted brace has one end formed into an eyelet, and a rod pivoted between the members of the brace is adapted to lie within the slot, the rod having hooks at its opposite ends to engage a card. The improvement forms a very cheap and simple device to advantageously hold and display a photograph or other card, and it may also be used as an easel, or to hang a card or photograph upon the wall, while it may be folded flat in small space, admitting of being sent conveniently through the mail.

TRUNK LOCK.—William J. Davis, Charlotte, N. C. This is an improvement in trunk, box or valise fastenings, in which the main lock coacts with other attachments to effect a locking adjustment when the main lock is operated. By means of the improved lock a trunk lid may be locked at three different points, or the improvement may be applied to secure the hinged and folding portions of a valise together, locking them at three points, and requiring the main lock to be unlocked and hasp pieces vibrated therefrom to release the supplementary locks near the ends of the receptacle.

WEIGHING SCALE.—John J. Hickey, New York City. This invention relates to an apparatus for weighing liquids, comprising a platform supported on a vertically sliding carrier and a counterbalancing lever carrying at one end the carrier and at its other end weights, each representing a certain predetermined measure. The apparatus is simple and durable, and is arranged to automatically and accurately weigh any desired measure of a liquid, according as the weights are placed.

WATER HEATING APPARATUS.—Adolph Schier, Chicago, Ill. This is an apparatus more especially designed for heating water for use in connection with soda water fountains, or for facilitating the making of hot drinks. It comprises a shell with hollow heads connected by tubes, with steam supply and return pipes for heating the water in the shell, and a return pipe is also connected with the faucet for drawing the hot water, whereby all water rising and cooling in the pipe will be returned, and only hot water drawn.

BASKET GRATE.—Erick J. Jahnson, Chicago, Ill. This grate has openings below which are arranged sliding racking grates, connected together for simultaneous operation. A central grate section is mounted to turn in one of the openings, and connected with the sliding racking grates below the other openings. The grate is very effective in operation and is more especially designed for use in fireplaces.

METALLIC SOLE AND HEEL PLATES.—Ferdinand Davison, Richmond, Va. This invention provides a machine for cutting these plates from a continuous sheet or band, the plates being cut and formed at one operation. The machine has a fixed cutter and a fixed head block, the latter having prong-forming dies, while a reciprocating plunger die having a cutting edge opposes the fixed cutter, and lateral extending portions are adapted to lap the fixed forming dies.

FIRE ESCAPE.—Gothard Lowenstein, Brooklyn, N. Y. A drum to be located on a building carries a flexible ladder, with a locking device by which it may be released from within the building, while connected with the ladder are pivoted prop pieces which fall into place when the ladder is let down for use, rendering the ladder stable, so that it will afford a safe means of descent. Means are provided for housing the ladder wrapped on the drum, so that it may be very readily and conveniently brought into service.

HOSE STRAP FASTENER.—Bernard W. McKenzie, San Diego, Cal. This is a double lever-like tool for applying and securing wire straps or ties to garden and other hose, to unite the hose to the couplings. The device saves wire and the brazing of the ends of the wire fastener together, with the consequent liability of the strap to break at the points where it is brazed together, and the fastener is readily adaptable to hose of different thickness or diameter.

HOSE BAND.—Isaac St. C. Goldman, Los Angeles, Cal. This is an improvement in bands adapted to be fastened to a hose to bind the hose upon the spindle of a coupling or other attachment to which the hose is to be fastened. It comprises a flexible body having parallel wire members, with a curved lever at one end, and may be quickly applied without the use of any special tools, and adjusted to fit hose of different sizes. Its operating lever exerts a progressive and increasing strain upon the band as it is tightened, the arrangement being such that the mere operation of the lever and bending of the fastening strap serves to bind the band in place, so that an auxiliary fastening is not necessary.

CHAIN OR CABLE GRIP.—Gilbert Gagnon, Pincher Creek, Canada. Combined with two levers loosely connected at one end, and loosely connected with two intervening grip blocks, are two link bars shackled to the other end of the levers and in turn connected together at opposing ends. The device may be quickly connected with the towing end of a logging chain or cable, and furnishes means for the ready connection therewith of a traction motor or a team of draught animals, for the sliding movement of the logs in any direction.

FENCE BUILDING MACHINE.—Benjamin O. Johnson, College Hill, Miss. This is a simple and durable machine, designed to do its work quickly, and that does not need skilled labor to operate it. It can be readily transported from place to place, and separates the wire strands to receive pickets, and twists or closes the strands around the pickets, to hold them firmly in the desired position. The construction is such that the strands of wire adapted to support the pickets are under constant and uniform tension while the machine is in operation.

FENCE.—John T. Patton, Highland, Ohio. This is a fence made mainly of wire, the invention providing means whereby the sagging of the fence may be prevented, while the wires may be quickly, conveniently, and effectually stretched and held under tension by a connected stretching device until they are secured in position.

WIRE STRETCHER.—George B. Steen, Ionia, Kansas. This device consists of an elongated body slotted at one end and provided with a handle at the other, a clevis being journaled on the body, and there being a ratchet connection between the clevis and the body. It is an extremely cheap and simple device, easily operated, and not readily wearing out, and it will effectually stretch a wire up to the post to which the stretcher is attached and hold the wire until it is fastened.

THILL COUPLING.—Alonzo P. Dodge, Huntington, N. Y. The axle clip of this coupling has on its under side a forwardly extending lug having in its inner side a socket entered by a knuckle or crank on the thill iron, a bolt with a web at its headed end passing through the knuckle and the lug of the clip. The device is very cheap and simple, facilitates the ready attaching or detaching of the thills, and the construction is such that there will be practically no wear on the coupling bolt, and the parts cannot become accidentally displaced.

SAFETY SNAP HOOK.—Alfred J. Sloan, Clyde, N. Y. This is an adjustable spring-jawed frame, between the jaws of which is pivoted a hook bar, the body of the hook and free ends of the frame limbs having a peculiar conformation that adapts them for efficient service as a snap hook, while provision is made to lock the hook bar in closed adjustment when this is desired.

WIRE STAND.—William Kadletz and Robert B. Stocker, Lemhi Agency, Idaho. This stand has a vertical body portion formed of parallel strands of wire, branching at their lower ends, where they are bent inward to form feet, while they also branch at their upper ends and terminate in eyes carrying suspending rings. A cheap, strong, and convenient stand may thus be made, especially adapted for use as a washstand.

ARTIFICIAL CLAW FOR FUR TRIMMINGS.—Abraham and James Jacobson, New York City. The invention comprises a plate having rigid claws simulating natural claws projecting from the fur, a strengthening of the fur at the paw being effected by means of the plate, thereby increasing its durability and preserving its appearance, while effecting a saving of time and labor in the attachment of the claws.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

THE WHITE CITY BY LAKE MICHIGAN. A souvenir in albertype. 31 photo. views. 12mo. New York: A. Wittemann. 1893. Price 50 cents.

This little album is worthy of a large sale. The thirty-one albertypes are soft and artistic. We quote from the publisher's circular: "These views were taken on the spot quite recently, and the collection is sold at fifty cents."

ANLEITUNG ZUR PHOTOGRAPHIE FUR ANFANGER. G. Pizzighelli. Fifth edition. Halle an der Saale, Germany: Wilhelm Knapp. 1893. 142 woodcuts, 254 pages.

This interesting little volume treats in a very popular manner the various subjects relating to photography and is more especially intended for amateurs and beginners. On the hand of a large number of illustrations and excellent test it will not fail to readily initiate the beginner into the wonderful mysteries of photography. The volume contains excellent formulas, both for the beginner and professional photographer.

DER NORD-OSTSEE KANAL. By C. Beseke. Kiel and Leipzig, Germany: Lipsius & Fischer. 1893. Three charts, tables, and graphic illustrations. 148 pages text.

The little volume treats the gigantic enterprise of connecting the Baltic with the North Sea by a maritime canal undertaken and almost completed by the German government. Maps showing the general construction and location of the canal are given, together with a history of the building and expenses of the canal, also its importance for commercial and war purposes.

☞Any of the above books may be purchased through this office. Send for new book catalogue just published. MUNN & Co., 361 Broadway, New York.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(5160) W. McG. asks: 1. What can I use in stove reservoir pipes that are used to heat water for a bath room, to prevent lime from gathering in the pipes? A. Strong caustic soda solution boiled in the pipes will loosen the scale, which may be washed out. If you can take the pipes apart, a sulphuric acid wash may break up the scale, and then wash out. 2. Can you give me plans to build a cheap Bell telephone? Can I use a battery with it? If so, what is the best way to construct it? A. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 142, for complete full sized drawing of a working telephone, 10 cents mailed.

(5161) J. A. S. asks: 1. What are the ingredients of rubber paint and what are its advantages, if any? Is it durable? A. Rubber paint is made by macerating rubber in any of the solvents until it has a pasty consistency; next dissolving in linseed oil until the solvent is evaporated, then mixing by grinding, a suitable quantity of pigment. This paint is said to be durable. 2. Is there any practical electric motor run by a battery that would be a success in the hands of users of small power who know nothing about electricity, and how about the cost of running same? I see it is proposed to run sewing machines, corn shellers, washing machines, etc. Can it be done cheaply? A. Electric motors driven by primary batteries are generally unsatisfactory, owing to the trouble and expense attending the maintenance of the battery. 3. How is Portland cement made? A. See SUPPLEMENTS 405, 386, 84, 901, 231.

(5162) F. P. H. asks: Is there anything I can use instead of borax to braze cast iron? I get quite a number of small cast cog wheels to repair; some times some of the cogs are broken and it would help me wonderfully to be able to braze them in, instead of dovetailing. A. For brazing cast iron use copper instead of brass. Borax for flux.

(5163) L. C. J. asks how to straighten hardened steel. A. In hardening and tempering tools they sometimes spring, to the great annoyance of the workmen, and not seldom the tool is reheated and rehardened. In most cases this may be avoided. To straighten a piece of steel already heated and tempered, heat it lightly—not enough to draw the temper—and it may be straightened by blows from a hammer, if the character of the tool will admit of such treatment, or, as in case of a tap, it may be straightened by a heavy mal-

let on a hard wood block. Although the steel when cold would break like glass with this treatment, when slightly warmed it will yield to moderately heavy blows uninjured.

(5164) W. S. writes: 1. I hear that it costs $2 a day to take cameras into the World's Fair grounds. Is that true? A. Yes. 2. Do they allow a camera taking a picture over 4×5 in the grounds? A. They do not, except in the case of photographers representing illustrated journals. Such photographers must obtain a special permit from the official photographer. 3. How many caustic potash batteries would it take to run a ¼ horse power electric motor. Cell contains 2 copper plates 4×5 inches, and 1 zinc plate 4×5 inches. Batteries to be coupled up like a bichromate plunge battery. A. It will probably require not less than 20 cells. 4. What size wire would it be necessary to wind the motor to adapt it to the caustic potash battery? A. No. 20 wire will probably be about right. The motor should have a resistance of from 20 to 30 ohms, depending upon the manner in which the battery is connected up. 5. Does the battery make more fumes than the bichromate cell? A. No. 6. How many hours will a bichromate plunge battery work 6 cells, size of plates 1½ inch by 4 inches? Will it work a motor for 5 hours? What is the voltage and amperage? A. 5 to 6 hours. The E. M. F. of each cell is 2 volts. The amperage depends upon the resistance in the circuit.

(5165) W. S. P. writes: 1. In regard to the induction coil in the home medical battery, what kind of wire is used in the primary coil, and how many feet? A. It will probably require 5 or 6 feet of No. 36 wire. 2. What number of wire or what kind is used in the secondary coil? How many feet in the secondary coil? A. 12 or 15 layers of No. 36 silk-covered magnet wire, 150 to 200 feet. 3. Do you think Grenet battery fluid is as good as elect opoion fluid for a Fuller bichromate battery? A. It is the same thing. 4. Is the Grenet fluid any good when it becomes black? A. No. 5. Could you give me some directions for making 3 pints of electropoion fluid? A. Make a saturated solution of bichromate of sodium in water, and slowly add one-fifth its bulk of commercial sulphuric acid.

(5166) C. T. V. asks: 1. What kind of electricity is that generated by the dynamo? A. Dynamic. 2. Why is so much precaution exercised in the stringing of fire alarm wires when only one wire is exposed to the dampness? A. Because the ground constitutes the other conductor, and any leakage from the wire to the ground impairs the efficiency of the line. 3. Can electricity, when grounded, be compared with water in regard to seeking its level? A. The earth is generally considered as an electrical reservoir; therefore the water analogy might be regarded as the proper one.

(5167) D. C. B. asks: 1. What is the E. M. F. of a nickel-plating dynamo of 40 gallons capacity? A. 7 or 8 volts. 2. About what size wire should I use on an electro-magnet to be used with this machine? A. This depends altogether on the size of the wire on the armature, but of course it will be necessary to use large wire, on account of the heavy current generated by the machine. 3. What is the cause of reverse current in plating dynamos, and how remedied? A. The secondary current from the plating vat. 4. It is a series-wound machine with a Siemens armature. I think its name is the "Little Giant." What change in the winding would adapt it for general experimental purposes? A. Wind the armature with finer wire. 5. What would be the power of the machine then? A. Without more data we cannot reply to this query. 6. Should the commutators of a dynamo change brushes when the poles of the armature are directly opposite the poles of the field magnet? A. It depends upon the winding of the armature. If the wires run from the coil straight out to the armature, the change should take place about half way between the poles. 7. Is plaster of Paris a good insulator? A. When dry it is a fair insulator.

(5168) W. E. S. asks: 1. Will you give me the formula for charging a Bunsen battery? A. Make a saturated solution of bichromate of sodium in water; to this slowly add one-fifth its bulk of commercial sulphuric acid. 2. Will zinc melt? A. Zinc melts at 680° Fah. 3. Can it be moulded smooth? A. It can be cast smoothly in metal moulds. 4. In what number of the SCIENTIFIC AMERICAN does it tell how to make an induction coil? A. You will find a full description of an induction coil in SUPPLEMENT, No. 160.

(5169) H. W. B., Jr., writes: I have seen described in the Notes and Queries of your paper a battery composed of sheets of zinc and copper with blotting paper in between; will you tell me what the paper is wet with, how thick should the zincs and coppers and the paper be to secure the best results? What would be the voltage, amperage and resistance of one composed of ten sheets of zinc and ten of copper, 10 inches by 6 inches? A. One half of the sheets in the battery referred to should be saturated with a solution of zinc and the other half with a solution of sulphate of copper. The blotting paper saturated with the sulphate of copper should be in contact with the copper, and that saturated with the sulphate of zinc should be in contact with the zinc. The zinc plates may be one-eighth of an inch, and for the copper any thickness will do, provided it is stiff enough to maintain its contact with the blotting paper. The voltage is about the same as that of a gravity, practically 1 volt, but the amperage is very small, owing to the resistance of the battery. Probably you will be able to secure a current of 3 or 4 amperes with such a battery.

(5170) G. R. asks the cause of holes about the size of a tackhead and larger on the sides of a stereotype plate, such as used on newspapers, after the tails are cut off. These holes form whether metal is poured hot or cold. A. The holes are caused by air, which in the operation of casting does not escape from the casting box.

(5171) A. Z. writes: 1. In Wimshurst electric machine described in "Experimental Science," could vulcanite be used for rotary disks? Would they be better than glass? A. Vulcanite can be used for this purpose, but it deteriorates with time. 2. Is standard supporting journal and axles of wood or metal? A. They are of wood. 3. Are tinfoil strips connecting brushes in electric connection with axle? A. No. 4. In trying to make Leyden jars we can hardly find any bottles or jars or window glass that will retain the electricity. What kind of glass or how prepared will answer the purpose? A. Use soda glass. Lead glass is a conductor of electricity, although a very poor one. The glass jar should be very thoroughly dried and varnished with shellac before being coated with tinfoil.

(5172) O. C. C. asks: 1. Please tell me the gross weight, charged, of a primary battery maintaining (for motor power) after a fifteen minutes' run about ¼ horse power. A. 50 to 60 pounds. 2. The shortest period in which such a battery (after say 15 minutes' service) will regain its prime strength? A. The battery will not of itself recover its original strength; it must be recharged. The process of fully recharging requires from 6 to 7 hours. 3. Which are the lighter and most serviceable—rubber or glass cells? A. Rubber cells.

(5173) T. T. writes: Recently during a thunder storm here a church was struck by lightning. The steeple was struck first, then the interior was visited, leaving a long streak where it had scorched the wall paper. It was afterward noticed that it followed an irregular gold stripe in the wall paper from the ceiling to the floor. Can you explain why this occurred? A. A very slight conductor serves to lead lightning in any direction, on account of its extremely high E. M. F.

(5174) M. C. P. writes: I wish to ask you a question in regard to my wood saw that I have just rigged up. It has a balance wheel weighing from 100 to 125 pounds, 26 inches in diameter, is a web wheel. I have been running it at about 1600 revolutions per minute. I run it with a horse power; the speed is sometimes higher, sometimes lower. Now, is it dangerous to run it at that speed? The machinist who cast the wheel said it was of good quality. My saw is 20 inches in diameter, and if I reduce the speed I am afraid it will not saw well. If it is not asking too much, please give me some information in regard to the matter. A. The tensional breaking strength of cast iron in the usual foundry practice cannot be trusted at more than 16,000 pounds per square inch. The safe load is made at one-sixth of the breaking strength per square inch or 2,666 pounds. The strain on the rim of your fly wheel at a speed of 1,600 revolutions per minute is 3,000 pounds per square inch, or a margin of a little over one-fifth of the breaking strain. This may be safe for good iron and a web wheel without flaws.

(5175) T. D. McC. asks: 1. In the Blake transmitter, is the fine wire wound next to core or on the outside? A. In the Blake transmitter the fine wire of the induction coil is wound upon the coarse wire. 2. Does primary circuit in an induction coil always refer to the inner circuit? A. Not necessarily, but according to the usual construction, the primary or coarse wire coil is placed on the core inside of the secondary coil.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

June 27, 1893

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Abdominal supporter, H. G. Suplee........ 500,356
Air lock, D. E. Moran........ 500,149
Alarm. See Fire alarm.
Album, C. F. Geyer........ 500,327
Animals from jumping, device for preventing, S. A. Nichols........ 500,152
Annealing wire, furnace for, J. McConnell........ 500,410
Asphalt disintegrating boiler, A. Haskins........ 500,495
Axle and box, wagon, J. Raddin........ 500,427
Axle nut, J. Bermel........ 500,464
Axle, roller bearing vehicle, S. J. Campbell........ 500,249
Bagasse furnace, Cohen & Herrmann........ 500,378
Baling press, hand, F. Posey........ 500,425
Balloon ship, G. T. L. Gabrielii........ 500,326
Bath, G. Elliott........ 500,479
Battery. See Galvanic battery. S condary battery.
Bed slat support, G. Luppert........ 500,406
Bee swarmer, catcher, and separator, combined, N. P. Fluent........ 500,197
Bell, alarm, A. Bruegger........ 500,187
Bending roll, W. Lewis........ 500,286
Bicycle frame, A. Winton........ 500,177
Bicycle saddle, J. H. Sager........ 500,156, 500,158
Bicycle seat, supplementary, J. H. Sager........ 500,157
Billet loop, F. J. Bringham........ 500,111
Billiard cha k cup, H. Van Hoevenbergh........ 500,360
Bit. See Expansive bit.
Bit stock, W. S. Parman........ 500,153
Bituminous substances, apparatus for reducing, refining, and separating, W. A. Doble........ 500,474
Blacking machine, boot or shoe, T. H. Lever........ 500,502
Blast furnace, J. M. Hartman........ 500,387
Blast furnaces, iron notch for, J. M. Hartman........ 500,386
Blind stile mortiser and borer, W. H. Brownfield. 500,278
Board. See Game board.
Boat. See Steam passenger boat.
Boiler. See Asphalt disintegrating boiler. Sectional boiler.
Bolt, J. A. Leggatt........ 500,143
Bolt cutter, C. L. Beers........ 500,184
Book, indexed, A. F. Dean........ 500,262
Bottle pour-out or discharger, J. W. Carter........ 500,260
Bottle, self-sealing, Hayes & Roberts........ 500,499
Bottle stopper, G. F. Atwood........ 500,182
Bottles, tool for securing corks in, K. Kirschner, Jr........ 500,395
Bouquet holder, C. A. Burbank........ 500,469
Boutonniere, H. W. Fishel........ 500,195
Box. See Dice box. Musicbox. Paper box. Resistance box.
Brace. See Rail brace. Ratchet brace.
Bracket, J. R. Barry........ 500,525
Brake. See Car brake. Vehicle brake.
Brake handle, S. A. Burns........ 500,529
Brick machine, D. H. Rice........ 500,510
Brick machine, re-press, D. J. C. Arnold........ 500,315
Bridge gate, L. Napion........ 500,290
Brush holder, S. H. Libby........ 500,144
Brush making tool, M. Young........ 500,247
Brushing machine, S. A. Sague........ 500,219
Bucket, dumping, J. A. Quinn........ 500,426
Buffer plate, F. P Davidson........ 500,227
Burner. See Oil burner.
Bushings, manufacture of, W. H. Bache........ 500,463
Buttons of mother-of-pearl, drilling machine for, E. Koenig........ 500,540
Cable, chain, G. Lindenthal........ 500,267
Cable protector, A. W. Lackey........ 500,399
Calendar, watch charm, pocket, and wall display, S. P. V. Arnold........ 500,314
Camera. See Photographic camera.
Can filling machine, Rowland & Helm........ 500,155
Car brake, J. W. Cooper........ 500,250
Car buffer, T. L. McKeen........ 500,414
Car coupling, W. S. Jennings........ 500,501
Car coupling, R. F. Ludlow........ 500,338
Car coupling, Mayer & Mitchell........ 500,342
Car coupling, W. B. Peoples *et al*........ 500,420
Car coupling, A. Testard........ 500,224
Car coupling, J. Timms (r)........ 11,348
Car coupling, Walker & Bedford........ 500,448
Car coupling, automatic, H. White........ 500,309
Car, mining, Corrigan & Fulkerson........ 500,114
Car motor, auxiliary, W. H. Schallioll........ 500,432
Car seat, F. H. Henry........ 500,204
Car vestibule, railway, T. L. McKeen........ 500,413
Car wheel moulds, core for, A. Hymas........ 500,500
Carriage jump seat, W. H. Sparks........ 500,354
Carrier. See Cash carrier. Lumber carrier. Package carrier.
Cartridge shells, machine for trimming, C. R. Richards........ 500,511
Case. See Egg case.
Cash carrier, H. M. Weaver........ 500,307
Cash register and indicator, E. F. Spaulding........ 500,164
Cask, petroleum, J. D. Sprunt........ 500,245
Chain, drive, C. W. Hunt........ 500,332
Chain link, drive, C. A. Taplin........ 500,223
Channeling and edge trimming machine, E. F. White........ 500,174
Chuck, W. G. Nelson........ 500,292
Chute, ash, R. C. Whayne........ 500,173
Circuit breaker, automatic, A. Wurts........ 500,456
Circuit for constant current machines, automatic short, A. Wurts........ 500,455
Clamp. See Picture frame clamp.
Cloth napping machine, C. F. X. Ott........ 500,347
Clothes pounder, G. W. Ainsworth........ 500,461
Clover huller screen shoe, J. N. Kailor........ 500,136
Coal drill, C. Grotz........ 500,124
Cock, ball, W. F. Lill........ 500,265
Condenser, Fitts & Anderson........ 500,196
Confectionery, etc., process of and apparatus for packing, J. R. Stout........ 500,303
Cooker, steam, W. F. Daggett........ 500,118
Corn husking machine, A. Smith........ 500,434
Corn sheller, C. F. Search........ 500,159
Corset, J. K. Ross........ 500,431
Corset or dress stay, C. S. Cole........ 500,471
Cotter, spring, W. Smith........ 500,162
Cotton press, W. S. Liddell........ 500,238
Coupling. See Car coupling. Thill coupling.
Crib, portable, W. J. Adam........ 500,459
Crimping machine, J. N. Heald........ 500,128
Cultivator, E. Pridmore........ 500,349
Cup. See Billiard chalk cup.
Curling iron holder for gas fixtures, D. Heer........ 500,232
Current motor, J. T. Bibb........ 500,465
Cut-out, electric, E. Egger........ 500,229
Cut-out for electric lighting systems, J. S. George, Jr........ 500,201
Cut-out, fusible, Young & Alden........ 500,248
Cutter. See Bolt cutter. Envelope cutter.
Damper, D. U. Cory........ 500,261
Dehorning implement, T. W. Tyler........ 500,443
Dental engine, R. D. King........ 500,139
Dice box, coin controlled, Edge & Fitzgerald........ 500,478
Dice, coin-controlled machine for throwing, B. M. Abell........ 500,313
Door hanger, Moore & Lundy........ 500,148
Door hanger track, R. W. Lundy........ 500,146
Door indicator, A. F. Brandenburg........ 500,316
Door opener, A. Rapp........ 500,211
Drawbar attachment, J. A. Hinson........ 500,331
Drawing head evening mechanism, A. Falls........ 500,120
Dredging and pumping apparatus, Wade & Cherry........ 500,445
Drill. See Coal drill. Metal drill.
Dusting apparatus, L. F. Neal........ 500,415
Egg case, Reber & Sefton........ 500,295
Electric generator and motor, Stanley, Jr., & Kelly........ 500,301
Electric heater, C. E. Roehl *et al*........ 500,272
Electric heater, E. P. Wetmore........ 500,520
Electric indicator, W. B. Luce........ 500,404
Electric lighter, B. Tropp........ 500,357
Electric lighting device, W. H. Clewley........ 500,192
Electric machine, dynamo, F. H. Loveridge........ 500,403
Electric machine or motor, dynamo, P. Lange........ 500,400
Electric motor, C. S. Jones........ 500,135
Electric motor, and dynamo-electric machine, R. M. Hunter........ 500,132
Electrical heater, J. F. McElroy........ 500,288
Elevator, M. M. Moore........ 500,344
Elevator, A. Pifre........ 500,241
Elevators, regulating switch for electric, See & Tyler........ 500,274
Embroidering machine, E. & R. Cornely........ 500,251
Engine. See Dental engine. Fire engine. Rotar steam engine. Steam engine. Wind engine.
Engraving or sinking dies, matrices, or other objects, machine for, L. F. Campi........ 500,317
Ensilage machine, J. O. Atkinson........ 500,181
Envelope cutter, D. W. Swift........ 500,304
Evaporating pan, H. W. Hescock........ 500,233
Expansive bit, L. S. Hayden........ 500,498
Extension table, F. P. Cobham........ 500,533
Extension table, A. R. Stebbins........ 500,440
Fabrics for gloves or the like, making warp, S. Spooner........ 500,165
Fan attachment, G. W. Grimes........ 500,489
Fanning mill, T. J. Hatfield........ 500,496
Feed apron, G. O. Wickers........ 500,521
Feedwater heater, W. H. Burk........ 500,377
Fence, portable, H. Knee........ 500,397
Fence post, S. P. Babcock........ 500,183
Fence post, Hunt & Morris........ 500,392
Fence post driver, L. H. Ketcha........ 500,138
Fibrous materials, apparatus for imparting variable motion to the traverse rods in machines for preparing and spinning, Cook & Harrison........ 500,113
File cases, flexible cover for, P. J. Pauly, Jr........ 500,419
Filtering and cooling water, means for, J. M. Bruce........ 500,528
Finger moistener, H. T. Marshall........ 500,339
Fire alarm, D. Hewitt........ 500,329
Fire engine, chemical, A. Bruegger........ 500,189, 500,190
Floor, roof, etc., T. A. Lee........ 500,208
Flue and chimney cleaner, W. H. Bliss........ 500,467
Flue expander, boiler, L. Biddle........ 500,466
Fork, H. P. Hull........ 500,207
Frame. See Bicycle frame.
Funnel, W. D. Thompson........ 500,517
Funnel, G. H. Wright........ 500,453
Furnace. See Bagasse furnace. Blast furnace. Plumber's portable furnace.
Gauge. See Ring gauge. Water gauge.
Galvanic battery, M. M. Hayden........ 500,284
Galvanometer, A. H. Hoyt........ 500,264
Game board, F. H. Monks........ 500,409
Garment supporter, E. S. Smith........ 500,437
Garment supporters, fastening for, E. S. Smith........ 500,353
Gas, apparatus for the manufacture of, H. M. Pierson........ 500,424
Gas manufacturing apparatus, W. A. Koneman........ 500,333
Gate. See Bridge gate.
Gate operating mechanism, N. Smith........ 500,161
Generator. See Electric generator. Steam generator.
Glue, making, Rauppach & Bergel........ 500,428
Governor, Brachhausen & Riessner........ 500,372
Grain drill feed device, J. J. Esler........ 500,323
Grain steeping and washing apparatus, W. H. Prinz........ 500,509
Granary, portable, W. J. Adam........ 500,458
Grate, J. J. Hall........ 500,493
Grate, G. W. Walker........ 500,446
Guano distributer, E. Wingate........ 500,246
Guard. See Velocipede mud guard.
Handle. See Brake handle.
Handle attaching device for picks or other tools, A. Walker........ 500,447
Hanger. See Door hanger. Picture hanger.
Harness, Snell & Weldon........ 500,516
Harness attachment, J. C. Camp........ 500,531
Harrow, revolving, Johnson & Syvrnd........ 500,253
Harvester and binder, Whiteley & Bayley........ 500,175
Harvester dropping or gaveling attachment, W. A. Line........ 500,402
Harvesters, platform and binder deck for grain, J. J. Dewey........ 500,321
Hay sling, J. Toney........ 500,168
Headlight, L. F. Wilder........ 500,176
Heater. See Electric heater. Electrical heater. Feedwater heater.
Heating apparatus, E. F. Edgar........ 500,228
Heel nailing machine, C. W. Glidden........ 500,486
Heel or edge trimming machines, shield oiler for, Worden & Diven........ 500,523
Hod, R. & R. J. Law........ 500,334
Hook and eye, H. Prym........ 500,210
Horse detacher, D. R. Brown........ 500,186
Horses, machine for driving, S. Williams........ 500,311
Horseshoe, J. McHarrie........ 500,150
Hot water circulating system, J. C. Norton........ 500,268
Indicator. See Door indicator. Electric indicator. Station indicator. Station potential indicator.
Indicator, A. Utzinger........ 500,359
Insulating device for preventing electric currents in pipes, S. D. Gratiaa........ 500,488
Interfering strap, E. F. Palmer........ 500,209
Joint. See Rail joint.
Knitted garment and makin same, W. A. O'Brien........ 500,269
Knitting machine, E. J. Franck........ 500,121
Knitting machine, automatic rib, McMichael & Wildman........ 500,151
Knitting machine thread-controlling mechanism, E. J. Franck........ 500,123
Knitting machine transfer appliance, E. J. Franck........ 500,122
Knitting machines, automatic controlling mechanism for circular, Reid & Stevenson........ 500,351
Lace fastener, A. Klinger........ 500,396
Lace fastener, shoe, C. F. Hathaway........ 500,497
Ladder and bench, combined step, E. B. Stebbins 500,439
Lamp, C. M. Cass........ 500,470
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Lamp, electric arc, C. A. Pfluger........ 500,422
Lamp filament, incandescent electric, J. Criggal........ 500,279
Lamp, flash or signal, E. Wenig........ 500,449
Lamps, hanging device for electric arc, C. A. Pfluger........ 500,421
Lantern, tubular, F. Dietz........ 500,381
Lasting machine, S. W. Ladd........ 500,141
Latch, J. Wright........ 500,179
Lavatory apparatus, C. S. Hill........ 500,234
Level, plumb, J. E. Worrell........ 500,452
Light. See Headlight.
Lightning arrester, M. M. Wood........ 500,178
Lightning arrester, W. Wurdack........ 500,454
Line holder and guide, J. H. Griswold........ 500,491
Loading device, C. W. Hays........ 500,328
Lock. See Air lock.
Locomotive, electric, F. M. Stevens........ 500,276
L om heddl eactuating mechanism, F. Buyck........ 500,112
Looms, pile wire for, G Segschneider........ 500,275
Lubricator, M. W. White........ 500,451
Lumber carrier, H. Hawkins *et al*........ 500,127
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Medical apparatus, electro, T. C. Hodgkinson........ 500,539
Metal drill, F. H. Richards........ 500,213
Metal rolls, shield for, T. D. Morgan........ 500,345
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Music boxes, damping device for, G. A. Brachhausen........ 500,369, 500,370
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Planter, potato, C. Irish........ 500,133
Platform. See Woodchopper's platform.
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Plow, gang or cultivator, J. T. Lucas........ 500,405
Plumber's portable furnace, F. C. & G. E. Loeble. 500,239
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Pole switch, double, C. A. Pfluger........ 500,423
Post. See Fence post.
Post driver, T. S. Wagoner........ 500,170
Power. See Tread power.
Power driving mechanism, T. F. Gaffney........ 500,484
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Preserving fruits or vegetables, M. B. Wever........ 500,450
Press. See Baling press. Cotton press. Mould press.
Press for expressing moisture, P. H. Grimm........ 500,490
Pressure regulator, J. G. W. Hartmann........ 500,126
Pressure regulator, A. N. Lucas *et al*........ 500,145
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Protector. See Cable protector.
Pulley, clutch, F. L. McKillip........ 500,289
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Pumping water, portable machinery for, H. J. Adams........ 500,460
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Push button cut out, J. S. George, Jr........ 500,200
Rail brace, Bryant & Kinkerter........ 500,376
Rail joint, F. H. Heath........ 500,388
Rail joint, Heath & Caldwell........ 500,389, 500,390
Railway cross tie, G. Lindenthal........ 500,266
Railway sleeper, metallic, H. G. Davis........ 500,473
Railway switch, S. J. Johnson........ 500,393
Railway trolley, conduit, E. P. Warner........ 500,306
Railways, inclosed conductor for electric, J. A. K. McGregor........ 500,506
Railways or tramways, construction of permanent ways for, J. E. Billups........ 500,366
Railways, system for supplying electricity to, M. H. Smith........ 500,256
Ratchet brace for bits or drills, D. M. Fulton........ 500,382
Ratchet wrench, G. W. Wood........ 500,277
Refrigerator, Metcalf & Doy........ 500,147
Register. See Cash register.
Regulator. See Pressure regulator.
Resawing machine, Surerus & Greenhill........ 500,167
Resistance box, E. Weston........ 500,362
Revoluble screen, D. E. Phillips........ 500,508
Ring gauge, G. R. Hughes........ 500,130
Roller. See Street roller.
Roof gutter, A. Neracher........ 500,416
Rotary steam engine, W. C. Knight........ 500,396
Rounding machine, A. B. Wagner........ 500,519
Saddle, E. S. Cross........ 500,472
Sash fastener, W. E. Mayo........ 500,254
Sawing machine, cold, G. Ehrhardt........ 500,193
Sawing machine, metal........ 500,194
Scale, bag holding weighing, M. B. Lloyd........ 500,337
Scoop, sifting, E. H. Whitney........ 500,542
Screen. See Revoluble screen.
Screw cutting dies, machine for the manufacture of, C. O. Harris........ 500,494
Screw, jack, Grimm & Williard........ 500,203
Scrubbing and mopping machine, Shively & Barclay........ 500,221
Seat. See Bicycle seat. Car seat. Carriage jump seat.
Secondary battery, King & Clark........ 500,394
Sectional boiler, W. H. Page........ 500,507
Sewing machine, K. Vogel........ 500,518
Sewing machine needle threader, E. C. Jenkins........ 500,235
Sewing machine shuttle, J. Robertson........ 500,430
Shaft, vehicle, A. Friedmann, Jr........ 500,2[illegible]3
Sheet lifting and counting device, J. W. Darley, Jr. 500,379
Sheet metal elbow, F. Dieckmann........ 500,119
Sheller. See Corn sheller.
Shirt and manufacturing same, W. A. O'Brien........ 500,270
Shoe, W. Hall........ 500,385
Signaling apparatus, police, W. H. Kirnan........ 500,285
Sink or other analogous construction, Donegan & Duenckel........ 500,475
Slate picker, Stoeckel & Fahringer........ 500,302
Soaps, process of and apparatus for the manufacture of kneaded or agglomerated, A. & E. des Cressonnieres........ 500,535
Solder, preparing, M. Guttner........ 500,125
Sole channeling machine, C. P. Stanbon........ 500,438
Spinning and balling machine, Monroe & Courtenay 500,343
Spinning machine, J. A. Collins........ 500,318
Spoke bending machine, P. Gendron........ 500,383
Spring. See Vehicle spring. Wagon spring. Watchcase spring.

Stamp, perforating, J. Stewart........ 500,258
Station indicator, S. S. Ackles........ 500,457
Station potential indicator, C. F. Scott........ 500,543
Steam coil superheating, H. C. Potter........ 500,242
Steam engine, E. H. Allred........ 500,462
Steam generator, T. L. & T. J. Sturtevant........ 500,166
Steam passenger boat, A. McDougall........ 500,411
Stirrup holder, safety, J. J. Rooney........ 500,512
Stone boats, metallic crook for, W. Allen........ 500,363
Stone composition, artificial, H. Gallinowsky........ 500,485
Stopper. See Bottle stopper.
Stove hood, Call & Clark........ 500,259
Stove, oil, C. H. Boeck........ 500,367
Strap. See Interfering strap.
Street roller, R. C. Pope (r)........ 11,347
Superheater, Scheetz & Ringle........ 500,514
Suspender end, J. M. Faust........ 500,324
Suspenders, A. F. R. Arndt........ 500,524
Switch. See Railway switch.
Switching device, A. M. Levin........ 500,335
Table. See Extension table. Train table.
Tack driving machine, J. E. Crisp........ 500,319
Tack driving machine, Crisp & Junkins........ 500,225
Tap holder, W. G. Nelson........ 500,291
Telegraphy, C. Cuttriss........ 500,226
Telephone, magnetic, C. S. Forbes........ 500,481
Test tube, E. S. Hoare........ 500,206
Therapeutic device, electro, W. E. Washburn........ 500,172
Thill coupling, J. & A. K. Warren........ 500,171
Tie. See Railway cross tie.
Tire, pneumatic, H. B. Boyd........ 500,468
Tire, pneumatic, I. W. Heysinger........ 500,205
Train table, A. J. Culbertson........ 500,537
Transplanting implement, B. F. Douthit........ 500,476
Tread power, C. F. Search........ 500,220
Trolley, W. H. Brodie........ 500,375
Trolley support, W. Duncan........ 500,263
Trolley wires, automatic disconnector for, R. N. Noyes........ 500,417
Truck, car, M. G. Hubbard........ 500,129
Truck for railway carriages, E. M. Turner........ 500,358
Trunk, wardrobe, etc., combined, C. Heumader........ 500,391
Trunks, etc., strengthening strip for, T. N. Rogers 500,352
Tube. See Test tube.
Tug, harness, G. W. Huntley, Jr........ 500,131
Tug, shaft, W. F. Sweet........ 500,441
Turret clamping mechanism, F. H. Richards........ 500,217
Type writer cabinet, G. C. Billups........ 500,185
Umbrella, folding, T. Hillabold........ 500,330
Valve, engine, F. Phillips........ 500,471
Valve for hydrocarbon engines, B. Drysdale........ 500,477
Valve for petroleum or other motors, mixing, F. A. Lehmann........ 500,401
Valve for steam pipes, relief, T. W. Moran........ 500,505
Valve seating machine, F. H. Richards........ 500,216
Valve seating tool, F. H. Richards........ 500,215
Valve, steam, H. Grossmann........ 500,492
Valve, steam actuated, E. A. Menking........ 500,407
Valves, seating, F. H. Richards........ 500,214
Vehicle brake, A. Bruegger........ 500,188
Vehicle seat back, W. A. Nason........ 500,240
Vehicle spring, L. Pentz........ 500,154
Vehicle spring, E. B. Smith........ 500,515
Vehicle wheel, F. H. Bolte........ 500,368
Vehicle wheel, E. J. L. Persil........ 500,293
Velocipede mud guard, A. Govan........ 500,384
Ventilator, H. W. Libbey........ 500,336
Voltmeter, static, A. E. Kennelly........ 500,236
Wagon bolsters, standard for, J. B. Ripsom........ 500,429
Wagon, delivery, S. D. Reynolds........ 500,533
Wagon spring, G. T. Chapman........ 500,532
Warping machines, rise roll mechanism for, A. E. Rhoades........ 500,541
Washing machine, Sharpe & Coldren........ 500,160
Watchcase spring, N. J. Felix........ 500,325
Water gauge, D. H. Roberts........ 500,298
Water gauge, Vetter & Broeker........ 500,444
Water wheel, A. F. Sparks........ 500,355
Weather strip, F. H. Mead........ 500,503
Weed exterminator, J. S. Dunlap........ 500,538
Well drilling machinery, J. G. Lee........ 500,142
Wheel. See Vehicle wheel. Water wheel.
Wind engine, S. W. Martin........ 500,340
Winding thread on plates, machine for, J. C. & F. A. Spach........ 500,163
Windmill, H. A. French........ 500,483
Window, cellar, L. Tremmel........ 500,169
Wood chopper's platform, J. B. Brickley........ 500,527
Wood, machine for embossing, Staber & Abbey........ 500,300
Wort from Indian corn, preparation of, C. Rach........ 500,294
Wrench. See Ratchet wrench.
Wristband, E. D. Smith........ 500,435
Yarn, device for catching and removing bunches from, T. J. Sands........ 500,243
Zinc ores, apparatus for and process of reducing, M. V. Smith........ 500,436

DESIGNS.

Belt, A. C. Bull........ 22,552
Cutlery handle, F. H. Arnold........ 22,563
Dish, covered, R. L. Johnson........ 22,565
Embroidery fabric, J. Frelloehr........ 22,553
Faucet, W. C. Winfield........ 22,570
Furnace front, T. I. Rankin........ 22,571, 22,572
Glass, plate, T. J. Woodward........ 22,566
Knives, etc., handle for, G. S. Boutwell........ 22,564
Medal, P. Philipsen........ 22,556
Monument, W. H. Perry........ 22,577
Scarf pin, F. Comte........ 22,555
Sheet metal, T. M. Stone........ 22,567
Show stand, A. L. Yearous........ 22,569
Spoon, C. Barclay........ 22,560
Spoon, W. S. O'Brien........ 22,561
Spoon, C. Otero........ 22,557
Spoon, A. G. Rogers........ 22,558
Spoon, D. G. Smallwood........ 22,559
Spoon, C. E. Winslow........ 22,562
Stove, G. H. Holland........ 22,575, 22,576
Stove, heating, G. H. Holland........ 22,573, 22,574
Textile fabric, E. Whitcomb........ 22,554
Umbrella stand, Sencenbaugh & Ives........ 22,568

TRADE MARKS.

Boots and shoes, Standard Shoe Company........ 23,243
Butter, Fox River Butter Company........ 23,257
Canned goods, Randall, Ruhl & Co........ 23,255
Cement, Portland, Aktieselskabet Aalborg Portland Cement Fabrik........ 23,278
Cement, Portland, Skanska Cement Aktie-Bolaget 23,277
leansing compound for the removal of spots and stains from fabrics, S. B. Mims........ 23,268
Corsets, Schilling Corset Co........ 23,242
Crackers, cakes, and biscuits, Independent Biscuit and Cracker Company........ 23,251
Dental dams, I. B. Kleinert Rubber Company........ 23,276
Eyes, artificial, F. A. Muller Sohne........ 23,275
Fertilizers, Cleveland Linseed Oil Company........ 23,279
Flour, Leaycraft & Co........ 23,259
Flour, Philip H. Postel Milling Company........ 23,260
Flour, wheat, A. C. & E. A. Pry........ 23,261
Flour, wheat, Star and Crescent Milling Company 23,262
Fodder for animals, Cleveland Linseed Oil Company........ 23,263
Grapes, I. Newton........ 23,249
Journal bearings, Babbitt metal and antifriction metal for, W. A. Rottmann........ 23,280
Lard, North Packing and Provision Company........ 23,258
Leather dressings, J. C. Ryan, Jr........ 23,281
Medicated soap, B. J. Douds........ 23,270
Milk product in the form of a prepared food for invalids and infants, W. Clark........ 23,252
Mineral spring water, H. K. Wampole & Co........ 23,245
Mineral waters, natural, Victoria Mineral Water Spring Company........ 23,246
Oysters in cans and wood packages, raw, C. H. Lighthiser........ 23,256
Perfumery, Lazell, Dalley & Company........ 23,272, 23,273
Piano actions, Wessell, Nickel & Gross........ 23,274
Pie, ready-made paste or composition for lemon, G. H. Higdon........ 23,253
Pop corn shelled, Albert Dickinson Company........ 23,250
Preserves, jellies, fruit butters, and mince meat, Van Lill Preserving Company........ 23,254
Remedies, certain named, J. P. Lavoie........ 23,266
Remedy for throat and lung troubles, J. F. Goldaine........ 23,265
Remedy, headache, C. F. Neubert........ 23,264
Salve for lumpy jaw in animals, F. C. White........ 23,267
Soap for cleaning carpets, rugs, and similar articles, Electric Cleanser Company........ 23,269
Soaps, toilet and laundry, W. M. Marcus........ 23,271
Whisky, Corning & Co........ 23,248
Wine, champagne, St. Arnould & Co........ 23,247
Worsted piece goods, Hinck & Ould........ 23,241
Yarns and threads, J. R. Leeson & Co........ 23,244

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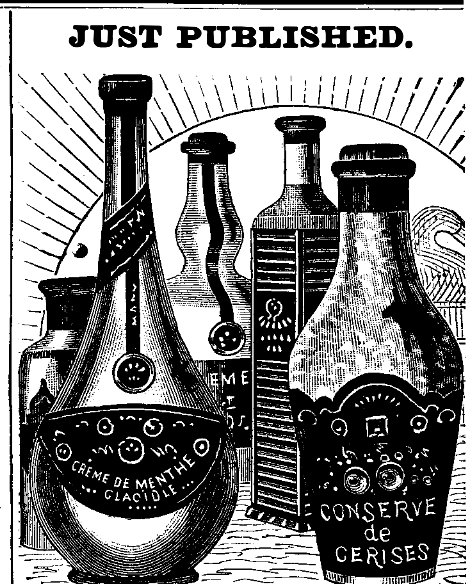

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